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June, 1945

EDISON
ELECTRIC INSTITUTE
BULLETIN

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THE ELECTRIC LIGHT AND POWER INDUSTRY

Current Statistical Data Covering 100 Per Cent of Industry

March, 1944 and 1945

SOURCE AND DISPOSAL OF ENERGY—MONTH OF MARCH

	1945	1944	%
GENERATION* (Net)			
By Fuel Burning Plants	12,048,360,000	12,533,059,000	− 3.9
By Water Power Plants	7,478,197,000	7,010,039,000	+ 6.7
Total Generation	**19,526,557,000**	**19,543,098,000**	**− 0.1**
Add—Net Imports over International Boundaries	147,514,000	112,333,000	+31.3
Less—Company Use	133,955,000	151,048,000	−11.3
Less—Energy Used by Producer	68,247,000	302,433,000	−77.4
Net Energy for Distribution	**19,471,869,000**	**19,201,950,000**	**+ 1.4**
Losses and Unaccounted for	2,595,146,000	2,414,187,000	+ 7.5
Sales to Ultimate Customers	**16,876,723,000**	**16,787,763,000**	**+ 0.5**

CLASSIFICATION OF SALES

NUMBER OF CUSTOMERS—As of March 31st			
Residential or Domestic	27,595,689	26,959,199	+ 2.4
Rural (Distinct Rural Rates)	1,151,609	1,103,038	.....
Commercial or Industrial:			
Small Light and Power	4,266,848	4,180,805	+ 2.1
Large Light and Power	152,302	149,088	
Other Customers	118,292	119,926	.....
Total Ultimate Customers	**33,284,740**	**32,512,056**	**+ 2.4**
KILOWATTHOUR SALES—During Month of March			
Residential or Domestic	2,888,990,000	2,688,543,000	+ 7.5
Rural (Distinct Rural Rates)	203,631,000	172,227,000	+18.2
Commercial or Industrial:			
Small Light and Power	2,501,353,000	2,462,882,000	+ 1.6
Large Light and Power	9,718,483,000	9,753,825,000	− 0.4
Street and Highway Lighting	187,447,000	185,732,000	+ 0.9
Other Public Authorities	686,572,000	812,470,000	−15.5
Railways and Railroads:			
Street and Interurban Railways	411,561,000	426,132,000	− 3.4
Electrified Steam Railroads	229,165,000	243,174,000	− 5.8
Interdepartmental	49,521,000	42,778,000	+15.8
Total to Ultimate Customers	**16,876,723,000**	**16,787,763,000**	**+ 0.5**
Revenue from Ultimate Customers	**$280,721,800**	**$275,465,400**	**+ 1.9**

RESIDENTIAL OR DOMESTIC SERVICE

AVERAGE CUSTOMER DATA—For 12 Months ended March 31st			
Kilowatthours per Customer	1,172	1,095	+ 7.0
Average Annual Bill	$40.90	$39.09	+ 4.6
Revenue per Kilowatthour	3.49¢	3.57¢	− 2.2

(*) By courtesy of the Federal Power Commission.

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 13 JUNE 1945 No. 6

FCC Radio Frequency Allocations

LAST fall the Federal Communications Commission undertook a revision of the frequency allocation to the various non-governmental radio services throughout the radio spectrum.* Following a hearing lasting several weeks, the Commission issued a report of proposed allocations above 25 mc. This proposal was the subject of a further hearing in February at which time additional testimony was presented by EEI and by the Radio Technical Planning Board on behalf of the electric utilities to the effect that the 20 frequencies proposed would not be adequate to take care of the postwar expansion of the utilities radio service.

Under date of May 25, 1945, the Commission issued a Report on final allocations of frequencies *above* 25 megacycles except the band 44-108 mc where further studies are in progress regarding the location of the frequency modulation broadcasting service. These allocations are shown in the accompanying table, pages 154, 155 and 156.

Electric, Gas, Water and Steam Utilities

A total of 31 channels are allocated to the "electric, gas, water and steam utilities, petroleum and other industries requiring similar radio service" as follows:

Frequency Bands	*No. of Channels*	*Channel Width*
23-30 mc	12	25 kc
30-40 mc	7	40 kc
104-108** mc	6	50 kc
152-162 mc	6	60 kc

No specific frequencies for these channels have as yet been designated. The Commission has stated that the new allocation plan will probably be ordered into effect service by service, taking into account among other factors the results of the Inter-American conference at Rio de Janeiro. Since the Inter-American conference is scheduled for this fall, this statement would indicate that the new channels will probably not be made available until some time after September. In the meantime licenses will presumably still be granted for the present Special Emergency Frequencies if a satisfactory showing of need for the Emergency Service can be made to WPB for release of the necessary radio equipment.

In the May 25 report the Commission does not amplify its intention, as expressed in the earlier report, to give consideration to the possibilities of permitting a broader use of radio by Utilities than allowed by the existing Special Emergency rules. However, it has been indicated that representatives of the industry will have an opportunity to comment on any new rules and regulations for this service before they are finally issued by the Commission.

In the briefs at the February hearing it was urged that the Utility classification be clarified by omitting the indefinite "and other industries requiring similar radio service." While the Commission did not grant this request, it does state in the Report: "However, in acting upon applications, the Commission will give due consideration to the needs of the power utilities and petroleum industry before permitting the use of these frequencies by other industries."

Common Carrier General Radio Telephone Service

The Commission has provided, on an experimental basis, 64 channels for a general mobile service. Of these channels 24 are for use in urban areas and 40 are for a highway service. Some applications by the Bell Telephone System companies for experimental licenses to initiate the urban service have been rejected because release of equipment could not be secured from the War Production Board. While WPB has indicated that equipment could be made available for the Emergency Services including police and public utilities, it appears that the proposed common carrier service, being a general service, may have to await easing of the present shortage of equipment resulting from the war effort.

Limited Private Radio Telephone Service

The Commission indicated its belief that the wide use of low power communication units will greatly increase the efficiency of many construction operations and will also contribute to the safety of life and the protection of property from loss in these activities. It accordingly allocated two channels in the 30-40 mc band for use by low powered provisional stations on a shared basis with experimental radio services. It is stated that the rules governing the operation of provisional radio stations will be appropriately amended. The exact scope of this service has not yet been defined, but it will evidently make the walkie-talkie type of equipment available for essential communications in line construction and similar activities.

Frequencies Below 25 Mc

The Commission has also issued a report dated May 21, 1945, giving proposed allocations *below* 25 mc, and setting June 20 as a date for further hearing. Although frequencies above 25 mc should generally be adequate to take care of the utilities' requirements, the Commission recognized that in some cases such as in mountainous and desert terrain, or where communication may be necessary over considerable distances along high tension power lines, pipe lines, or water supply aqueducts, use of frequencies below 25 mc may be required. With respect to these lower fequencies the Commission states "while it is not possible at this time to designate specifically the frequencies which will be assigned for this purpose, it is anticipated that in so far as possible frequencies will be allocated for use by the electric, gas, water and steam utilities in accordance with RTPB request." The request referred to was for six frequencies in the range between 2 and 4 mc.

* See E.E.I. BULLETIN, November and December, 1944, issues, pages 341 and 389, respectively.

**As an alternative this may be the 74-78 mc band depending on the final allocation to FM broadcasting.

TABLE OF ALLOCATIONS—25,000 KC TO 30,000,000 KC

The following table contains the allocations of frequencies to the various non-governmental radio services from 25,000 to 30,000,000 kilocycles. The table also contains for convenient reference the international allocations which the Commission will recommend to the Department of State and the allocations which the Interdepartment Radio Advisory Committee is proposing for the governmental radio services.

Freq. Band Mc.	Proposed International Allocation	United States Allocation	
25.015-27.185	Fixed and Mobile except Aero and Maritime	Gov. and Non-Gov. Fixed and Mobile	Note 1
27.185-27.455	Scientific, Industrial and Medical	Scientific, Industrial and Medical	
27.455-28	Fixed and Mobile except Maritime	Gov. and Non-Gov. Fixed and Mobile	Note 1
28-29.700	Amateur	Amateur	
29.700-30	Fixed and Mobile except Maritime	Gov. and Non-Gov. Fixed and Mobile	Note 1
30-30.5	" " " " Aero.	Government	Note 2
30.5-32	" " " " "	Non-Gov. Fixed and Mobile	Notes 2 & 3
32-33	" " " " "	Government	Note 2
33-34	" " " " "	Non-Gov. Fixed and Mobile	Notes 2 & 3
34-35	" " " " "	Government	Note 2
35-36	" " " " "	Non-Gov. Fixed and Mobile	Notes 2 & 3
36-37	" " " " "	Government	Note 2
37-38	" " " " "	Non-Gov. Fixed and Mobile	Notes 2 & 3
38-39	" " " " "	Government	Note 2
39-40	" " " " "	Non-Gov. Fixed and Mobile	Notes 2 & 3
40-40.96	" " " " "	Government	Note 2
40.96-41	Scientific Industrial and Medical	Scientific, Industrial and Medical	
41-42	Fixed and Mobile except Aero.	Government	Note 2
42-44	" " " " "	Non-Gov. Fixed and Mobile	Notes 2 & 4
	44-108 Mc. - Alternative No. 1		
44-48	Amateur	Amateur	
48-50	Broadcasting	Facsimile	
50-54	"	Educational FM Broadcasting	
54-68	"	Commercial FM Broadcasting	
68-74	Broadcasting Fixed and Mobile	Television	
74-78	Fixed and Mobile, except Aero.	Non-Gov. Fixed and Mobile	Notes 5A & 6
78-84	Broadcasting Fixed and Mobile	Television, Fixed and Mobile	Note 5
84-90	" " " "	" " " "	" "
90-96	" " " "	" " " "	" "
96-102	" " " "	" " " "	" "
102-108	" " " "	" " " "	" "
	44-108 Mc. - Alternative No. 2		
44-50	Broadcasting, Fixed and Mobile	Television, Fixed and Mobile	Note 5
50-56	" " " "	" " " "	" "
56-60	Amateur	Amateur	
60-66	Broadcasting, Fixed and Mobile	Television, Fixed and Mobile	" "
66-68	Broadcasting	Facsimile	
68-72	"	Educational FM Broadcasting	
72-86	"	Commercial FM Broadcasting	Note 5A
86-92	Broadcasting, Fixed and Mobile	Television	
92-98	" " " "	Television, Fixed and Mobile	Note 5
98-104	" " " "	" " " "	" "
104-108	Fixed and Mobile, except Aero.	Non-Gov. Fixed and Mobile	Note 6
	44-108 Mc. - Alternative No. 3		
44-50	Broadcasting, Fixed and Mobile	Television, Fixed and Mobile	Note 5
50-54	Amateur	Amateur	
54-60	Broadcasting, Fixed and Mobile	Television, Fixed and Mobile	" "
60-66	" " " "	" " " "	" "
66-72	" " " "	" " " "	" "
72-78	" " " "	" " " "	Notes 5 & 5A
78-84	" " " "	Television Broadcasting	
84-88	Broadcasting	Educational FM Broadcasting	
88-102	"	Commercial FM Broadcasting	
102-104	"	Facsimile	
104-108	Fixed and Mobile, except Aero.	Non-Gov. Fixed and Mobile	Note 6
108-112	Air Navigation (Localizers)	Government	
112-118	Air Navigation (Ranges)	Government	
118-122	Aero Mobile (Airport Control)	Airport Control	
122-132	Aero Mobile	Aero Mobile (primarily Non-Gov.)	
132-144	Fixed & Aero Mobile	Government	
144-148	Amateur	Amateur	
148-152	Fixed & Aero Mobile	Government	
152-162	Fixed & Mobile except Aero.	Non-Gov. Fixed & Mobile	Note 7
162-174	Fixed & Mobile	Government	

TABLE OF ALLOCATIONS—25,000 KC TO 30,000,000 KC (Continued)

Freq. Band Mc.	Proposed International Allocation	United States Allocation	
174-180	Broadcasting Fixed & Mobile	Television & Government	
180-186	" " " "	" " "	
186-192	" " " "	Television, Fixed & Mobile	Note 5
192-198	" " " "	" " " "	" "
198-204	" " " "	" " " "	" "
204-210	" " " "	" " " "	" "
210-216	" " " "	" " " "	" "
216-220	Fixed & Mobile	Government	
220-225	Amateur	Amateur	
225-328.6	Fixed & Mobile	Government (Military) with adequate channels to be reserved for civil aviation.	
328.6-335.4	Air Navigation Aids (Glide Path)	Air Navigation Aids (Glide Path)	
335.4-400	Fixed & Mobile	Government (military) with adequate channels to be reserved for civil aviation.	
400-420	Fixed & Mobile (incl. Radio Sonde)	Government (including Radio Sonde)	
420-450	Air Navigation & Amateur	Amateur & Air Navigation	Note 8
All Non-Government services will be established in the bands above 450 Mc on an experimental basis pending adequate showing as to need and technical requirements.			
450-460	Air Navigation	Non-Giv. Fixed & Mobile	Note 9
460-470	Fixed & Mobile	Citizens' Radio	
470-480	Broadcasting	Facsimile Broadcasting	
480-920	"	Television	
920-940	"	Experimental Broadcast Services	
940-960	Fixed & Broadcasting	Fixed & Experimental Broadcasting	Note 10
960-1145	Navigation Aids	Navigation Aids	
1145-1245	Amateur	Amateur	
1245-1325	Fixed & Mobile except Aero.	Television Relay	
1325-1375	Fixed & Mobile	Non-Gov. Fixed & Mobile incl. Aero	
1375-1600	" " "	Government	
1600-1700	Air Navigation Aids	Air Navigation Aids	
1700-1750	Meteorological	Meteorological	
1750-2100	Fixed & Mobile except Aero.	Non-Gov. Fixed & Mobile	
2100-2300	Fixed & Mobile	Government	
2300-2450	Amateur	Amateur	
2450-2700	Fixed & Mobile except Aero.	Non-Gov. Fixed & Mobile	
2700-2900	Meteorological & Air Navigation Aids	Meteorological & Air Navigation Aids	
2900-3700	Navigation Aids	Navigation Aids	
3700-3900	Air Navigation Aids	Air Navigation Aids	
3900-4400	Fixed & Mobile except Aero.	Non-Gov. Fixed & Mobile	
4400-5000	Fixed & Mobile	Government	
5000-5250	Air Navigation Aids (Instrument landing)	Air Navigation Aids (Instrument landing)	
5250-5650	Amateur	Amateur	
5650-7050	Fixed & Mobile except Aero.	Non-Gov. Fixed & Mobile	
7050-8500	Fixed & Mobile	Government	
8500-10000	Special Navigation Aids	Government	
10000-10500	Amateur	Amateur	
10500-13000	Fixed & Mobile except Aero.	Non-Gov. Fixed & Mobile	
13000-16000	Fixed & Mobile	Government	
16000-18000	Fixed & Mobile except Aero.	Non-Gov. Fixed & Mobile	
18000-21000	Fixed & Mobile	Government	
21000-22000	Amateur	Amateur	
22000-26000	Fixed & Mobile	Government	
26000-30000	Fixed & Mobile except Aero	Non-Gov. Fixed & Mobile	
30000-Up	Experimental	Experimental	

NOTES

Note 1—On the basis of an average channel width of 25 kc. provisions will be made for the following services in the band 25 to 28 mc.:

Class of Station	*No. of Channels*
Relay Broadcast and Geophysical	24
Power, Petroleum, etc.*	12
Provisional and Experimental	10
Relay Press and Motion Picture	6
Aeronautical (Primarily Flight Test & Flying School)	7

* Other industries requiring similar radio service.

Note 2—No change proposed in existing services between 30 and 44 mc. outside of the Continental United States.

Note 3—On the basis of an average channel width initially (see Sec. 2 of Part 1) of 40 kc. provisions will be made for the following services in the band 30 to 40 mc.:****

Class of Station	*No. of Channels*
Provisional and Experimental	2
General Highway Mobile**	20
Maritime Mobile and Geophysical	5
Forestry and Conservation (6 shared with Maritime Mobile and 6 shared with Urban Transit)	29
Special Emergency	6
Power, Petroleum, etc.*	7
Urban Transit, Provisional and Experimental	5

(*Notes continued on next page*)

NOTES (Continued)

Class of Station	*No. of Channels*
Fire	15
Police	36
Low Power Provisional and Experimental****	2

* Other industries requiring similar radio service.
** May provide radio communication service to all types of mobile units such as marine, land vehicles, aircraft, etc. Pending final determination of the best method of operation of this service these channels will be assigned on an experimental basis—12 for development on a common carrier basis, 4 for trucks and 4 for buses, except in those cases where it is shown that a different distribution is more desirable.
*** Antenna input power limited to 5 watts peak.
**** In addition, 11 government channels are to be designated in this band.

Note 4—On the basis of an average channel width initially (see Sec. 2 of Part I) of 40 kc provisions will be made for the following services in the band 42 to 44 mc.:

Class of Station	*No. of Channels*
Maritime Mobile and Geophysical	5
General Highway Mobile**	26
Police	24
Provisional and Experimental	1

** May provide radio communication service to all types of mobile units such as marine, land vehicles, aircraft, etc. Pending final determination of the best method of operation of this service, these channels will be assigned on an experimental basis—12 for development on a common carrier basis, 4 for trucks and 4 for buses, except in those cases where it is shown that a different distribution is more desirable.

Note 5—Provision may be made for the operation of non-governmental fixed and mobile services (such as, police control and relay circuits, point-to-point, marine control circuits, forestry fixed circuits, rural telephone, broadcast studio to transmitter links, railroad, terminal and yard operations) upon proper showing of need and that these channels may be shared on a mutually non-interfering basis.

Note 5A—Aeronautical markers to remain on 75 Mc with adequate guard bands as long as required or until moved to another suitable frequency.

Note 6—On the basis of an average channel width of 50 kc provisions will be made for the following services in the band 74-78 (or 104-108) mc.:

Class of Station	*No. of Channels*
Provisional and Experimental	2
Forestry and Conservation	8
Power, Petroleum, etc.*	6
Urban Transit—Forestry and Conservation	6
Special Emergency (Including Highway Maintenance)	
Provisional	10
Fire	12
Police	36

* Other industries requiring similar radio services.

Note 7—On the basis of an average channel width of 60 kc provisions will be made for the following services in the band 152 to 162 mc.:

Class of Station	*No. of Channels*
Police	36
Fire	12
Provisional and Experimental	2
Relay Press	4
Forestry-Conservation, Geophysical	
Power, Petroleum, etc.*	6
Maritime Mobile	8
Urban Mobile**	24
Rural Subscriber Telephone	
Short Distance Toll Telephone	
Relay Broadcast	12
Motion Picture, Geophysical, Forestry-Conservation	
Provisional and Experimental	2
Railroads	60

* Other classes of stations rendering similar radio services.
** May provide radio communication service to all types of mobile units such as marine, land vehicles, aircraft, etc. Pending final determination of the best method of operation of this service these channels will be assigned on an experimental basis—12 for development on a common carrier basis, 4 for trucks and 4 for buses, except in those cases where it is shown that a different distribution is more desirable.

Services now operating between 156 and 162 mc. may continue temporarily on a non-interfering basis in the 152 to 162 mc band.

Note 8—To be used temporarily for "Special" air navigation aids. Band to be exclusively Amateur when no longer required for "Special" air navigation aids; meanwhile Amateur peak power to be limited to 50 watts.

Note 9—To be temporarily used for "Special" air navigation aids and reserved for Non-Government services when no longer required for "Special" air navigation aids.

Note 10—May be used by low power fixed point-to-point stations for such services as studio-transmitter links, control circuits, police fixed facsimile circuits, etc.

Mayott Honored for Work with OWU

LAST month a power expert of the Office of War Utilities, WPB, packed his bag and took a train north from Washington, his job of guiding the power supply of the country during a critical period of the war finished.

When he reached his home town of Hartford, Conn., there to resume his position on the technical staff of the Hartford Electric Light Company, a testimonial dinner was given in his honor.

Clarence W. Mayott was the power company executive thus feted.

His triumphant arrival home was in sharp contrast to his departure for Washington more than three years before. Then there had been dire prophecies of electric power shortage in numerous parts of the country. Then it was claimed in some circles that a lack of power would cause war goods to arrive in too little quantities and too late.

Mr. Mayott was lauded for his efforts in coordinating southeastern electric power plants by Samuel Ferguson, president of the Hartford Electric Light Company, who was toastmaster at the gathering. Mr. Ferguson traced the history of centralized power supply in this country and described the governmental coordination during this war.

As speakers at the Hartford dinner made known, it was "Cap" J. A. Krug who sought Mr. Mayott out to come and help in Washington. And it was Mr. Mayott's work which went a long way toward inspiring the tribute Mr. Krug later paid to the outstanding war record of the business-managed light and power companies of this nation.

Photo courtesy, *Hartford Courant*

Mr. Mayott is Congratulated by Utility Leaders

Left to right: Edward Falck, director of the Office of War Utilities; Colonel H. S. Bennion, vice-president and managing director of the Edison Electric Institute; Samuel Ferguson, president of the Hartford Electric Light Company; Mr. Mayott; Clyde O. Fisher, Connecticut Public Utilities Commissioner; and Tom P. Walker, president of the Council of Electric Operating Companies.

"We Have a Peach of a Story to Tell"

Business-Managed Electric Companies vs. Bureaucratic System in Canada

By J. B. Hayes

President, Canadian Electrical Association

From an address before the annual Western Conference, C.E.A., Vancouver, B. C., March 14, 1945

WE are gathered here as the leaders of Western Canada, leavened by a few Easterners, employed in an industry that has contributed greatly to the successful prosecution of the war. Without our contribution it is not hard to imagine the handicap under which our Armed Forces would carry on. Our electric industry is in fact one of a team of champions, because the public utilities in all branches have risen nobly to their tasks.

In the words of a slogan for a previous Victory Loan "Nothing matters now but Victory." Our entire resources should be and have been devoted to fighting the enemy in as direct a way as possible. But now we find ourselves thrust into a kind of civil war in which we are fighting for our very existence. I think this state of affairs is deplorable, but we cannot escape the fact that in some parts of Canada the investor-owned electric companies are fighting for their very lives.

* * *

This address will involve no debate or controversy. I propose to recite certain established facts about our business, and as President of a Dominion-wide Association, I propose to speak from a National and not a local point of view. The source of my information is the latest statistics published by the Dominion of Canada which cover the year 1942. This annual compilation is divided in two parts, covering Municipal and Commercial undertakings, which I prefer to call public-owned and investor-owned utilities. Both types of ownership are, as you know, well-established in Canada. Quoting figures directly is usually a dull and fruitless task, both for the speaker and the listener. I therefore shall reduce the significant facts to simple easily understood ratios.

* * *

From the statistics I have referred to I have deduced a number of facts. Please imagine a board back of my head with half a dozen pegs on it. I propose to place one fact after another on these pegs and briefly describe them. When I say "we" I mean of course investor-owned companies as represented at this meeting, and by "they" I mean the public-owned electric utilities:

1. WE PRODUCE FOR 23 CENTS WHAT COSTS THEM $1.00.

If the operating expenses are divided by the volume of electricity produced we get the average cost per kwhr, and for the two types of operation the ratio of cost of production is 23 to 100. The first question that comes to one's mind is why should such a large spread be true in fact, and the major reason seems to be that the public-owned utility employs so much more staff than do the private companies. If we divide the volume of electricity produced by the number of employees that do the producing we find the fact that goes on the second peg.

2. WE PRODUCE THREE TIMES AS MUCH PER EMPLOYEE AS THEY DO.

You know as well as I do that one of our executives or employees is not in fact three times as productive as the corresponding executives and employees in their undertakings; and even if we were, the modesty that characterizes electric people, and especially Nova Scotians, would prevent us from claiming any such advantage. I have studied the statistics on which this talk is based in order to discover some major reason for this wide difference, and I can find one and only one. The size of the average customer with us is materially greater than the size of the average customer with them, and therefore one must expect that the smaller customer would tend to require greater unit staff and greater unit cost. Only because I wish to avoid expressing an opinion do I leave it to you to estimate how far this factor comes from accounting for such a difference in efficient operation.

Let me make it clear that I mean no reflection on the ability of the engineers and others who are responsible for the operation of public-owned undertakings. It is the clammy hand of the bureaucratic system that suppresses initiative and enterprise, and is responsible for the situation I am describing.

Now turning to the charge that we make, we can put this fact on the third peg.

3. WE CHARGE 40 CENTS FOR WHAT THEY CHARGE $1.00.

This is the real cost and excludes only taxes from both sides. Our costs include interest charges and profit and their costs include carrying charges. This question of profit does not appear to be emphasized as much these days as it used to be, because people generally seem to recognize that both types of business use, in effect, public money.

As I said a moment ago the above ratio excluded taxation and we now come to the factor that our critics give most weight to at the moment. You will find local politicians pointing out the large sums that are being collected from their parts of the Dominion and sent to Ottawa that would be "saved" to the local communities if municipal ownership were substituted for private ownership. That this appears true is shown by fact No. 4.

4. OUR GOVERNMENT LOST SEVENTEEN MILLION DOLLARS IN 1942 IN TAXATION.

This is the additional money that would have been collected had the electric industry been taxed on a uniform percentage basis. It represents in effect a subsidy paid to that part of the electric industry that is public-owned. It is surely not unreasonable to expect that the Dominion of Canada would tax its citizens without discrimination, but no effort has been made in these five war years to correct the present inequitable policy. I know of no engineering reason and I know of no economic reason why the correction should not be made; so I am forced to conclude that the reason is political. This is a subject in

which I am woefully ignorant, but the Dominion of Canada in 1942 could have added Seventeen Million Dollars to its treasury without having to pay any interest charges for it.

Whether the policy of our utility paying heavy taxes is bad or not I think it cannot be called reprehensible. I do not know how it is in other parts of Canada, but in my own company in Nova Scotia for every dollar we paid to the Dominion last year in Excess Profits tax we received over two dollars from the Dominion for the sale of electricity, largely for use in direct prosecution of the war; probably similar situations exist elsewhere. It may be argued that it is not unfair for an electric company to return to Ottawa half the amount that Ottawa pays it for electric service in order to make a contribution to carry on our National effort.

* * *

This taxation burden can be simplified by another statement which I will hang on the next peg.

5. TO SUPPORT OUR COUNTRY ONE OF OUR CUSTOMERS IS WORTH THIRTY-THREE OF THEIRS.

I am again using as I have all through this discussion, national figures from the 1942 report of the Bureau of Statistics. Such a statement as this seems silly. I can hardly seriously claim that one resident of Quebec is worth 33 residents of Toronto; or that one resident in Halifax is worth 33 residents of Truro or that one resident in British Columbia is worth 33 residents of Ontario. We are all the same kind of people, and yet the stern fact is that it takes 33 of their average customers to pay as much tax as one of ours.

Down in the beautiful island of Jamaica there are a number of native proverbs each telling a simple truth in homely language. I should like to have the attention of our taxation authorities at Ottawa drawn to a simple one of four words—*"Greedy—Greedy—Choke—Puppy."*

But up to now we are still vulnerable because of the tax that we have to pay and pass on to our customers. So let us add in all taxes and get a fact to hang on the final peg.

6. INCLUDING ALL TAXES WE SELL FOR 51 CENTS WHAT THEY SELL FOR $1.00.

That completes the story. With all the advantages of so-called "cheap" money and freedom from taxation they charge nearly twice as much per kwhr as we do, and yet advocates of public ownership are persistently urging the substitution of their form of organization for ours. I don't know what other companies will do to meet this situation, but as far as we are concerned in Nova Scotia we are making major electric rate reductions with a view to the elimination of the Dominion of Canada Excess Profits tax, and this will lend point to the proverb I referred to above, "Greedy Greedy Choke Puppy."

Let me now repeat the six facts that I have set before you:

1. We produce for 23 cents what costs them $1.00.

2. We produce three times as much per employee as they do.

3. We charge 40 cents for what they charge $1.00.

4. Our Government lost seventeen million dollars in 1942 in taxation.

5. To support our country one of our customers is worth 33 of theirs.

6. Including all taxes we sell for 51 cents what they sell for $1.00.

Gentlemen there is our ammunition. If we must take time off from our complete absorption in the war to defend ourselves, surely we have the necessary facts. Let us step out and use them. Too long have we been appeasing Government. We have a good story, we are an industry with a proud record that is reaching to still more usefulness; don't let us be too modest and hide our virtues any longer. We have a peach of a story to tell, and haven't yet told it, let's go ahead and do it.

Electric Water Systems Council Issues "Proof" Booklet

"HERE'S Proof of what an Electric Water System will do for You" is the title of a new booklet just issued by the Electric Water Systems Council of which M. W. Arthur, Vice-President, Consumers Power Co., Jackson, Michigan, is national chairman.

The booklet consists of statements by representative farmers who tell how their electric water systems are helping them to produce more meat, milk, poultry, and vegetables, as well as providing comfort, convenience, and fire protection.

The book has an immediate and a long-range objective. The immediate aim is to help increase food production by the use of running water, as described in the book. The long-range objective is to keep the many advantages of a mechanized farm water supply before prospective buyers in the postwar period.

By publicizing the experiences of farmers who have found their water systems an invaluable aid in increasing production, the booklet is aiding the water system industry in pre-selling the postwar market and thus reaching the goal of 500,000 electric farm pumps and water systems in the first full year of unrestricted production. Manufacturers now engaged in the water system business have ample production capacity to achieve this postwar goal.

The booklet contains testimonial statements on the advantages of electric water systems from various types of farmers including a general farmer, a stockman, a dairy farmer, a poultryman, a gardener, and a farm housewife. Each statement is signed by the farmer and is accompanied by illustrations taken on the farm.

Jack Harvey, RFD No. 2, Utica, Michigan, says: "Both Mrs. Harvey and I are very enthusiastic about the advantages made possible on our 200 acre farm by our electric water system. With the help of only one hired hand, I do all the farm work myself—cultivating 110 acres of corn, oats, wheat, and hay, besides caring for 25 milk cows. Having water piped to the house, barn, yard and garden makes our job a lot easier."

Erwin Rush has a farm of 240 acres near Romeo, Michigan. The farm was cleared for cultivation 75 years ago by his grandfather. Mr. Rush says: "In these busy times when we are working so hard to speed up production of meat and poultry of all kinds, we can truthfully say that our electric water system, which has served us faithfully for 17 years, is the cheapest and most efficient hired help we can get."

That drinking bowls in the dairy farm are a wonderful asset is the testimonial of William Manska, RFD No. 1, Armada, Michigan. Mr. Manska says that "Running water in our milk house saves much time and labor when replacing the water bath in our electric milk cooler as well as in keeping the floor clean and rinsing the dairy utensils."

Proof of the advantage of running water in the poultry business is supplied by Mr. and Mrs. George Johnson of Webster Road, Webster, New York. "Water is a feed, composing about 65 per cent of a hen's egg and fowl's body," says Mr. Johnson. "Our system has not only meant greater production of poultry and eggs but the labor saved over the old method of pumping and carrying the water we needed has paid for its installation many times."

Guy E. Studebaker is a gardener at New Carlisle, Ohio. "We had been growing potatoes for 32 years before we installed an irri-

(*Continued on page* 180)

Recent Developments in Infra-Red Applications

By A. D. Spillman
Philadelphia Electric Co.

Presented before the Interstate Power Club, New York, May 14, 1945

WE have now passed a decade in which infra-red installations have been made in increasing numbers—especially during this war period. Hundreds of installations have been made in industries for the purpose of speeding the production of war materials. Infra-red has been a most valuable tool in baking finishes on jeeps, tanks, airplane engines and parts, landing mats, mine cases and a host of other items that are manufactured into implements of war. Industries' experience with this method of drying and baking, which has reduced processing time from hours to minutes, will lead to a further adaptation to post-war civilian production requirements.

Ford's early installations proved highly successful and resulted in the installation of over 63,000 lamps at River Rouge, and comparatively large units in various assembly plants. In our own territory, for example, the Ford Co. installed a tunnel consisting of 1900 240-watt (456 kw) drying lamps mounted in gold plated reflectors for the purpose of drying paint on Army tanks while they are being driven, under their own power, through the tunnel. The drying time is four minutes compared to the former 24 hour drying method. Because of their earlier experience with infra-red we believe this same equipment will be rearranged during peace time to bake finishes on automobile bodies. It is our understanding that this will be supplemented by larger units and that their infra-red load alone will exceed our present connected infra-red load of 4100 kw by at least 50 per cent. With five minute drying time instead of 50 minutes we may hope for faster car production when peace is again established.

Most of us are familiar with the flexibility of infra-red equipment for baking various size and shaped pieces, the space saving that is possible, its safety and ease of control. We have progressed through various adaptations of the clear filament (tungsten or carbon) lamp mounted in gold plated or vaporized aluminum reflectors to the self-contained and most widely used reflector drying lamp, commonly known as the R-40 lamp, rated at 250 watts. This lamp is now used by a number of infra-red equipment manufacturers in a panel construction which can be arranged to follow the contour of the work being put through the oven. Prices of this type oven construction have been as low as $25 per kw compared to prices as high as $80 per kw when 1000 watt bi-post lamps mounted in special sealed-beam reflectors were offered to the market.

We also have a trend to more completely enclosed ovens with auxiliary fans for recirculation and designs to incorporate convected as well as radiant energy. There has also been some indication of combining the speed of infra-red lamp sources at 2500 deg. F, or 4000 deg. F for rapid preheating, or bringing up to temperature, with electric convection heating. This might apply in cases where it seems desirable to heat up quickly and where the cycle requires holding for a specified time at that final temperature. In such an installation the holding heat zone would be insulated in accordance with good oven practice and electric resistance elements would supply the losses necessary to hold the work at temperature.

The manufacturers of infra-red lamps have been handicapped in further lamp development work because of the pressure of war work. However, there is reason to believe that when conditions permit they will carry on investigations which will include higher wattage lamps for higher heat concentration and a harder heat resisting glass bulb for use where the process involves water or other liquid vapors—to eliminate lamp breakage and failure.

I have received an estimate of $1,250,000 as representing the lamp industries' output of infra-red lamps during the past year. The equipment manufacturers' output for the same year is estimated at $3,500,000. If this latter figure is correct and we use $35 per kw the result would be 100,000 kw installed load. This would not include a large number of units which are small or assembled by the user.

The lamp manufacturers estimate their war time production as double that of the prewar period and they are as much as six months behind in filling orders. In the post-war period the demand is expected to exceed pre-war figures and in five years after peace the infra-red lamp production is projected to reach 20 per cent more than last year's war time output.

While we recognize that the manufacturers of infra-red equipment have contributed greatly to the speeding up of baking applications, which were essential to the production of war materials, we all know the important contributions some of the paint manufacturers have made in providing paint formulas which would lend themselves to rapid drying when exposed to infra-red.

Paint baking has been the most widely used and publicized infra-red application. This has been most valuable in meeting war production schedules. I will cover a few of these applications in our own territory which are of interest together with a few comments on conversion after the war.

Steel landing mats used in temporary landing fields at strategic military outposts have been painted for protection against corrosion. This paint coating has been dried in a continuous conveyor infra-red oven consisting of 78 1000-watt sealed-beam reflector units. After drying in 8 to 10 minutes and after leaving the conveyor line the sections are packed and ready for shipment. It is possible this same equipment will be used after the war for drying paint on architectural metal products—this customer's peace time business.

Mine cases for the Navy are sprayed with black paint on the outside and drying is accomplished in 12 minutes by passing through infra-red lamp banks. In this instance the customer's distribution is 440 volt, 3-phase and four 115 volt lamps are connected in series. Plans are under consideration to rearrange these lamp banks for baking finishes on the outer cylindrical casings of domestic type water heaters—this customer's peace time business.

Steel cartridge cases, finished in gray, are carried on a conveyor system through infra-red lamp banks and drying is accomplished in 10 minutes. This manufacturer, in peace time, produces domes-

tic ranges, and we believe that conversion to drying enameled range parts will follow after the war.

Gun mounts being manufactured in another plant are painted and then dried by means of infra-red. After the war these will most likely be adapted to baking finishes on sheet metal products such as refrigerator cabinets and automobile body parts.

We have an illustration of reconversion in an oven which was originally installed to bake finishes on utility cabinets which are made in a variety of sizes, shapes and colors. If you will visualize a cabinet 18 in. x 18 in. x 6 ft. high, I think you will agree that this is a difficult baking job because of the width and depth of the cabinet as well as the fact that a large percentage of the cabinets are painted white, and white is the most difficult finish to bake uniformly and without scorching. In this case the cabinets are placed on a circular base which can be rotated as the cabinets are sprayed and as they later travel through a totally enclosed infra-red oven equipped with 102 kw of infra-red lamps. The baking time is eight to 10 minutes. During the war this oven was converted to the use of baking finishes on tool boxes for the Army, first aid kits, etc. After the war the unit will no doubt be reconverted to this customer's production of peace time metal cabinets.

It is important that good paint, good tools and good equipment be used for efficient economical operation. Indirectly electrostatic spraying and "detearing" may be tied in with infra-red paint drying on metal parts. A properly applied coat of paint will result in a better finished product. This brings us to equipment such as has been placed on the market by the Harper J. Ransburg Co. for electrostatic coating and "detearing." In paint spraying by hand, or by mechanical high pressure method, there is generally considerable waste of paint. In using the electrostatic coating process the article to be sprayed passes through a high voltage electric field in which there is a discharge between wire electrodes and the piece to be coated. The fine paint particles sprayed into this field from fixed guns are attracted to the piece and deposited on it. The result is an extremely uniform coating with paint saving claims running as high as 50, and even 75 per cent. It is best adapted to pieces of uniform size and shape in continuous production lines. The power pack is rated at 1 kw and the voltage in the electrostatic field is 80,000 to 120,000 volts d-c. The same power pack is adaptable to "detearing"—that is, to the removal of drops on the edges of work that has been dipped.

I would like to comment on some other applications of infra-red which are not paint drying and which we have found to work advantageously for the customer.

A manufacturer of aircraft parts, such as wing sections and tail pieces, was experiencing difficulty in drying large aluminum sheets after a cleaning and rinsing operation. Two men on this work attempted to dry these sheets by wiping with cloth. This invariably resulted in drops adhering in certain places and when the sheets were stacked these drops were trapped. Infra-red was tried and the customer installed 136 R-40 lamps with the result that the sheets were completely dried in about one minute compared with the three minutes required when wiping with cloth. Here we have a highly reflecting surface and yet the heat absorption and drying was good.

We recently conducted some tests in a storage battery manufacturer's plant to determine the possibility of drying the paste filled in storage battery grids. We found that after 20 seconds exposure the filler had dried sufficiently to permit stacking the plates and that five minutes exposure was sufficient to dry the plate. As a result 96 250-watt reflector drying lamps were installed in the form of a nine foot tower to permit one to pass upward and another to pass downward to the unloading table. It is interesting to note that this operation had formerly been done in a propane-fired convection oven in which the drying time was as high as 24 hours. The new infra-red tower performs the operation in 46 seconds.

Most of us are familiar with the use of infra-red in the quick drying out of motors and generators which were put out of service by floods. Portable infra-red units for this purpose have been of extremely great value to war industries which were exposed to flood conditions during the critical stages of the war.

The foregoing illustrations show how infra-red can be used successfully and economically for dehydration—bearing in mind that the moisture removal is of relatively low percentage.

Another application which has created interest in that used by the Philadelphia Transportation Co. to preheat crank cases of buses parked in open lots during the winter time. The infra-red lamps are mounted in specially constructed pits with four R-40 lamps to a unit. The bus is driven over the pit and the lamps turned on. The P.T.C. installed 27 such pits at one location. They parked an average of 20 buses per day during the period December 8, 1943, to April 6, 1944. The lamps were used 80 days out of the 120 for 10 hours daily. They have estimated their savings over the winter to amount to about 5000 gallons of gasoline and 5000 engine operating hours by heating the engines this way.

The use of infra-red for drying textiles should expand when more lamps, equipment and time for research are available. Applications include supplemental drying of woolen cloth, in carbonizing and in the sizing of rayon and nylon thread. Another use in drying fabrics impregnated with resinous materials appears to offer good possibilities. This requires temperatures of 285 to 300 deg. F for curing—a temperature not generally attainable in the conventional steam-heated dryers. Infra-red as a supplemental unit to such dryers should offer good post-war potentialities. The finished fabric is waterproof and wrinkleproof, and progress made with such fabrics during the war should be encouraging for the future.

Other applications which are being made include the following:

The infra-red drying of pottery for chinaware as it comes from the automatic jigger machines has revolutionized the pottery industry.

Preheating plastics prior to forming also offers more extensive possibilities for the use of infra-red.

Air heaters for the home and the office and a variety of uses such as in brooders and other space heating applications will incorporate infra-red lamps.

In the post-war era we may look for more competition from gas infra-red. Many comparisons have been made to date. Invariably these point to faster baking and consequently higher production rates. In some cases they have used the same length tunnel with the same number and spacing of radiant cup burners as in an infra-red tunnel. However, in one instance, the output of one cup burner was more than 7844 Btu compared to the 853 Btu of one 250 watt lamp. In other words, on a theoretical Btu basis, the gas installation had nine

(*Continued on page* 164)

Finances of the Bonneville Project—1944

By W. M. Carpenter
Economist, Edison Electric Institute

"THE fiscal year 1944 marked a turning point in the history of the Bonneville Power Administration" states the latest Annual Report of Paul J. Raver, its Administrator. "After seven years of intensive construction activity, the Administration has completed a transmission grid system of more than 2,500 miles of high-voltage lines. During the year the Bonneville powerhouse was brought to completion and the 6th, 7th and 8th generators were installed at Grand Coulee Dam. . . . With the completion of these major facilities . . . there has been a sharp swing toward the operating phases of the Administration's activities."

With this shift from construction to operation, the Annual Report of the Secretary of the Interior contains its first detailed financial statement on the Bonneville Power Administration. While this leaves much to be desired in the matter of complete information, it comes as a welcome change after the statistical blackout which has prevailed since 1941. In its provisions for interest charges the new pro-forma income statement is a model which might well be imitated by other government agencies.

The report reveals once more the advantages which accrue to tax-free Federal projects under a system of accounts which permits the transfer of large amounts of cost to mythical navigation benefits and to irrigation as yet undeveloped.

For the first time there is shown a balance sheet for the transmission and distribution part and a pro-forma consolidated income statement for the entire enterprise. From these, some interesting deductions may be drawn. Roughly speaking, barely half the real fixed charges are applicable to the generation of the power. The balance has been paid by the taxpayers of the United States in the name of a navigation in the lower river (all of which would have been there without Grand Coulee) consisting in 1941 of less than a million tons of which general freight was only 4780 tons;[1] and in the name of a visionary irrigation scheme which will ultimately entail the pumping of water through a vertical lift of almost 300 feet.

[1] Traffic through Bonneville lock, 1941, was 255,991 tons rafted logs; 409,937 tons of fuel oil and gasoline, 214,081 tons sand and gravel, 38,844 tons of wheat and 4,789 tons of miscellaneous cargo. (Report of Chief of Engineers, U. S. Army, 1942, part 2, p. 1244.)

Conflicting Figures

It is impossible to arrive at any exact figures for this enterprise. The statements of the various Bonneville officials before Congress differ sharply from those of the Department of the Interior on the same subject, and all of them are again at variance with the Department's own printed report. Still other sets of figures are presented by various members of Congress and appear from time to time in the Congressional Record. [A general observation is pertinent at this point on data contained in Congressional speeches. While the presumption is that the figures have been prepared by the officials of the various public agencies in good faith, they have been so prepared in response to demands which are not always clearly phrased and are often subject to qualifications that do not appear either in the tabular matter or in the discussions. Usually they refer to different periods of time or represent revisions of earlier figures on undisclosed bases. All this creates such a bewildering complexity of contradiction that the student is advised to confine himself to official printed reports and to rely upon the Congressional records only as general indications of policy. Note the following extract:

"Rep. Jones (Ohio): 'There is no one standing between fraud and honesty except the Congress of the United States. All I am saying is that they (Dr. Raver, Administrator, and Mr. Marlett, Controller of the Bonneville Power Administration) made a mistake. Their figures do not jibe. Each agency has given costs and expenditures and power generation charges which build up the financial statement in the eyes of the Congress that make each of them look good'."

At the same time, Congressional Committees have the redeeming feature of being able to drag out of witnesses valuable information which otherwise would have been concealed from the public.]

The following is quoted verbatim from the Annual Report of the Secretary of the Interior and, by means of information in Congressional records, an estimate may be made of the allocation of joint costs to power and the degree to which the actual costs of power are being sloughed off to "other facilities" and so borne by the general taxpayer.

Capital Investment

"Information supplied by the Bureau of Reclamation and the United States Army Engineers in regard to the investment in general projects as of June 30, 1944, is given below. The data exclude interest during construction and are subject to account review, (page 58).

INVESTMENT IN GENERATING PROJECTS—JUNE 30, 1944

	Bonneville Dam	*Grand Coulee Dam*	*Total*
Joint purpose facilities	$38,471,999	$137,783,405	$176,255,404
Direct power facilities	36,106,635	37,494,424	73,601,059
Direct navigation facilities	5,490,895	.....	5,490,895
Direct irrigation facilities	.....	5,266,182	5,266,182
Total	$80,069,529	$180,544,011	$260,613,540

What the Taxpayers are Carrying

Appendix A shows the facsimile of part of a table which appeared during a Congressional debate on the appropriations to be made for the next fiscal year for various Federal agencies. While it does not agree with the above table and while there are numerous unexplained features, it nevertheless does give a distribution of the investment in fixed capital between the various facilities. In condensed form, this table shows the following for June 30, 1944:

	Total Investment	*Power*	*All Other*
Bonneville Transmission System	$ 74,842,589	$ 74,842,589	.....
Bonneville Dam, direct power	37,584,418	37,584,418	.....
Bonneville Dam, allocated joint facilities	44,624,479	20,093,230	$ 24,531,249
Grand Coulee, direct power	47,752,406	47,752,406	.....
Grand Coulee, allocated joint facilities	125,222,157	41,949,430	83,272,727
Grand Coulee, direct irrigation	7,785,445	.....	7,785,445
Total	$337,811,494	$222,222,073	$115,589,421

At Bonneville, 45 per cent of the cost of joint facilities is apparently charged to power; at Grand Coulee, only one third; and the taxpaying public of the United States is carrying the charges of operation, depreciation and interest on $116,000,000 of investment. These charges last year totaled $4,350,000.

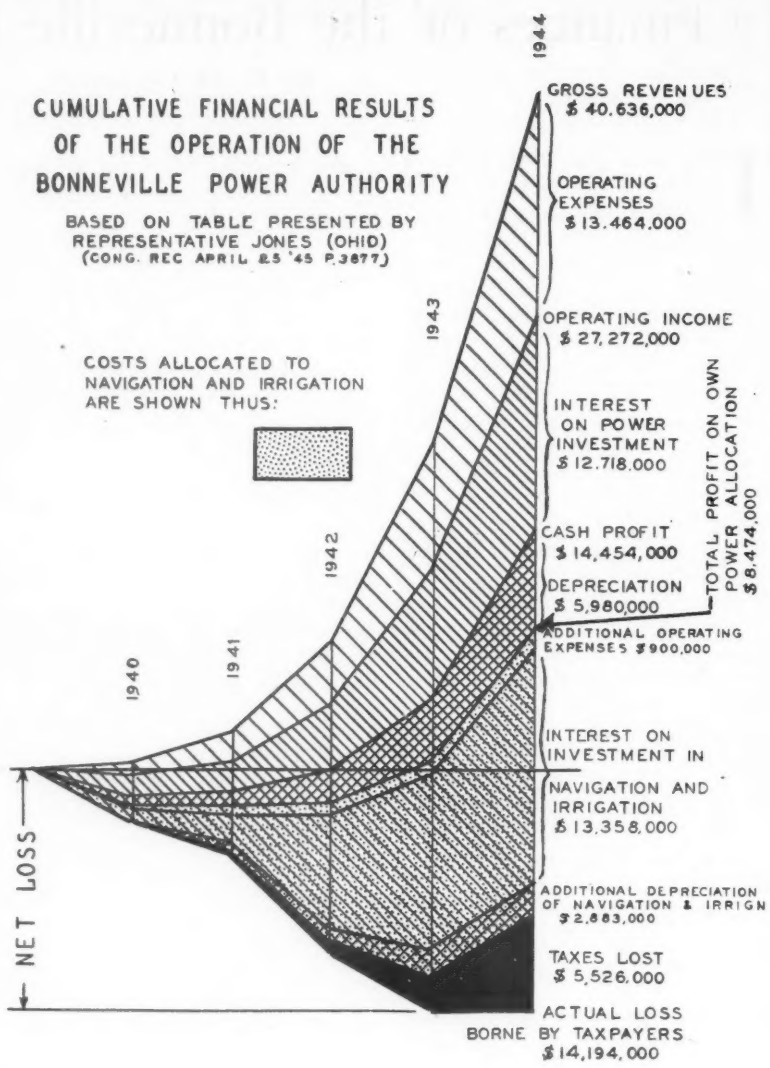
Appendix B shows the facsimile of part of a pro forma income statement which appeared in the same issue of the Congressional Record and which carried back each year to 1940 the figures for the amounts by which the project is subsidized under the guise of navigation and irrigation. This is shown graphically on the chart. Since the start of operations in 1940, the Bonneville Power Administration has cost the taxpayers of the United States some $14,000,000; against which the project itself shows a cumulative paper profit of $8,474,000.

Income Statement—1944

The following is quoted verbatim from page 60 of the 1944 Annual Report of the Secretary of the Interior:

"Upon the completion of accounting analyses and financial negotiations now under way with the Bureau of Reclamation and the Corps of Engineers, War Department, the accounts of the Administration will reflect the application of revenues in much the same way as private industries apply revenue to meet operating expenses, including the cost of power produced at the two Federal dams, interest on the power investment, and repayments of the power investment through an amortization schedule. Inasmuch as these analyses and agreements have not been completed, a consolidated actual financial statement is not available; but the adjoining pro forma statement for the fiscal year 1944 indicates the administration's approximate financial position.

"This pro forma statement is based upon information that is now available as to the costs of operating the two generating projects and as to the allocation of the joint investment at these projects to power purposes. In the event the ultimate allocations differ from presently used assumptions, the indicated power cost will be affected. In addition, final figures will reflect adjustments due to the inclusion of interest during construction, and determination of final depreciation and amortization policies. Despite the tentative character of the statements it is believed that the results are fairly indicative of the answers that may be fully developed.


CUMULATIVE FINANCIAL RESULTS OF THE OPERATION OF THE BONNEVILLE POWER AUTHORITY
BASED ON TABLE PRESENTED BY REPRESENTATIVE JONES (OHIO) (CONG. REC APRIL 25 '45 P.3877)
COSTS ALLOCATED TO NAVIGATION AND IRRIGATION ARE SHOWN THUS:
1940
1941
1942
1943
1944
GROSS REVENUES $ 40,636,000
OPERATING EXPENSES $ 13,464,000
OPERATING INCOME $ 27,272,000
INTEREST ON POWER INVESTMENT $ 12,718,000
CASH PROFIT $ 14,454,000
DEPRECIATION $ 5,980,000
TOTAL PROFIT ON OWN POWER ALLOCATION $8,474,000
ADDITIONAL OPERATING EXPENSES $900,000
INTEREST ON INVESTMENT IN NAVIGATION AND IRRIGATION $ 13,358,000
ADDITIONAL DEPRECIATION OF NAVIGATION & IRRIGN $2,883,000
TAXES LOST $ 5,526,000
ACTUAL LOSS BORNE BY TAXPAYERS $14,194,000
NET LOSS

"Bonneville Power Administration pro forma Statement of Consolidated Income (Partially Estimated), Fiscal Year 1944

Revenues			$20,893,363
Operating expenses:			
Bonneville Power Administration	$3,377,487		
Bonneville Dam project	382,600		
Grand Coulee Dam project	993,329		
Shasta Units: Rental and special costs	1,000,000		
		$5,753,416	
Depreciation:			
Bonneville Power Administration	1,119,429		
Bonneville Dam project	439,100		
Grand Coulee Dam project	700,000		
		2,258,529	
Total operating revenue deductions			8,011,945
Net operating revenue			12,881,418
Income deductions (interest):			
Bonneville Power Administration	$1,846,057		
Bonneville Dam project	1,100,000		
Grand Coulee Dam project	2,195,000		
Total income deductions			5,141,057
Net income from power operations			7,740,361"

"The statement for fiscal 1944 reflects the actual revenue, operating expenses, depreciation and imputed interest for the Bonneville Power Administration, together with estimates for the expenses, depreciation, and interest at the two dams allocable to power. The statement also reflects estimates of the costs at the dams for operation, depreciation on power facilities including an allocated share of joint items, and imputed interest on the power investment, both direct and joint. The statement thereby indicates the consolidated result of operations, which is a net income of $7,740,361 for the fiscal year and is available for amortizing or repaying the investment."

Summary—Tax Free Status Saves BPA Some $5,000,000 a Year

This 1944 figure for net income is

APPENDIX A

EXHIBIT D.—*U. S. Government Columbia River power system—Schedule of plant investment as of June 30, 1944*

		Total as of June 30, 1944			Present commercial power	Irrigation	Navigation and flood control	Future river regulation
		Investment	Interest during construction	Total				
Columbia Basin project:								
Direct power facilities		$45,888,220	$1,862,186	[1] $47,752,406	$47,752,406	----------	----------	----------
Joint facilities, including interest on power portion	$127,396,173							
Less earnings during construction to Jan. 1, 1942	$177,170							
Work Projects Administration costs assigned to work relief	1,947,318							
Donations by State of Washington	49,528							
	2,174,016							
Net joint facilities to be distributed		121,970,634	2,251,523	125,222,157	[2] 41,949,430	$53,227,079	$1,000,000	$29,045,648
Direct irrigation facilities		7,785,445	----------	7,785,445	----------	7,785,445	----------	----------
Total Columbia Basin project		175,644,299	5,115,709	180,760,008	89,701,836	61,012,524	1,000,000	29,045,648
Bonneville Dam project:								
Direct power facilities		36,330,585	1,253,833	37,584,418	37,584,418	----------	----------	----------
Joint facilities navigation		43,639,012	985,467	44,624,479	20,093,230	----------	24,531,249	----------
Total Bonneville Dam project		79,969,597	2,239,300	82,208,897	57,677,648	----------	24,531,249	----------
Bonneville Power Administration: Transmission facilities		74,151,011	[3] 691,578	74,842,589	74,842,589	----------	----------	----------
Grand total		329,764,907	8,046,587	337,811,494	222,222,073	61,012,524	25,531,249	29,045,648

[1] A portion of the ultimate power facilities cost will be allocated to irrigation when the power facilities used for irrigation pumping are installed.
[2] Allowance has not been given to elimination of interest during construction on a relatively small amount of plant retired.
[3] Includes $5,346,373 for River Regulation for Bonneville Dam, of which amount $529,244 is interest during construction.

NOTE.—The allocations of joint facility investment to power, irrigation, etc., are preliminary inasmuch as they have not been officially approved.

APPENDIX B

Columbia River power system—Pro forma combined statement of income, showing how the taxpayer comes out if all features of the investment were repaid

	Fiscal year 1940 and prior	Fiscal year 1941	Fiscal year 1942	Fiscal year 1943	Fiscal year 1944	Total to June 30, 1944	Estimate, July 1 to Dec. 31, 1944	Total to Dec. 31, 1944
Operating revenues and other income:								
Sales of electric energy	$426,544	$1,895,503	$5,320,319	$11,979,472	$20,835,262	$40,457,100	$11,649,000	$52,106,100
Other electric revenue	----------	120	33,839	43,252	60,666	137,877	14,000	151,877
Other income	----------	----------	11,675	16,901	12,540	41,116	----------	41,116
Total operating revenues and other income	426,544	1,895,623	5,365,833	12,039,625	20,908,468	40,636,093	11,663,000	52,299,093
Operating expenses:								
Bonneville Power Administration	526,793	601,057	1,806,155	2,877,599	3,617,432	9,429,036	1,947,000	11,376,036
Bonneville Dam project	321,787	163,271	242,699	298,212	414,798	1,440,737	212,500	1,653,237
Grand Coulee Dam project	----------	----------	106,245	674,146	1,813,968	2,594,359	970,000	3,564,359
Total operating expenses	848,580	764,328	2,155,069	3,849,957	5,846,198	13,464,132	3,129,500	16,593,632
Depreciation expense:								
Bonneville Power Administration	50,430	230,539	547,955	923,379	1,119,429	2,871,732	672,000	3,543,732
Bonneville Dam project	365,585	198,296	263,686	349,610	473,126	1,650,303	237,500	1,887,803
Grand Coulee Dam project	----------	----------	179,482	594,792	683,374	1,457,648	500,000	1,957,648
Total depreciation expense	416,015	428,835	991,123	1,867,781	2,275,929	5,979,683	1,409,500	7,389,183
Total operating expense and depreciation	1,264,595	1,193,163	3,146,192	5,717,738	8,122,127	19,443,815	4,539,000	23,982,815
Net	838,051	702,460	2,219,641	6,321,887	12,786,341	21,192,278	7,124,000	28,316,278
Interest expense:								
Bonneville Power Administration	229,279	425,271	931,969	1,547,630	1,846,058	4,980,207	963,000	5,943,207
Bonneville Dam project	800,381	462,084	485,839	692,441	1,123,697	3,564,442	600,000	4,164,442
Grand Coulee Dam project	----------	----------	673,925	1,688,071	1,811,635	4,173,631	1,235,000	5,408,631
Total interest expense	1,029,660	887,355	2,091,733	3,928,142	4,781,390	12,718,280	2,798,000	15,516,280
Net income	(1,867,711)	(184,895)	127,908	2,393,745	8,004,951	8,473,998	4,326,000	12,799,998
Additional operating expenses Bonneville Dam project	270,593	132,975	149,182	158,631	187,879	899,260	----------	----------
Additional depreciation	171,331	311,805	956,914	760,727	682,012	2,882,789	----------	----------
Additional interest:								
Bonneville Dam project	688,935	1,130,826	1,276,549	1,237,255	925,153	5,278,718	----------	----------
Grand Coulee Dam project	----------	----------	3,127,375	2,395,917	2,557,265	8,080,557	----------	----------

[1] Indicates red figure.

subject to two qualifications. It is based upon the cost allocations previously mentioned and does not include the sums currently paid by the country at large for "navigation" and "irrigation." Through the entire report there is no mention of taxes or tax equivalents. In 1944, the private companies in the two states of Oregon and Washington paid in state and local taxes about 10 per cent of their gross revenues, or 2 per cent of their fixed capital. At this rate, the people of these states are losing $2,100,000 a year in tax collections if figured on the basis of revenue, or twice that amount if figured on allocated fixed capital. In addition to this, the people of the United States as a whole lost about $2,250,000 last year in income taxes, making a total annual tax loss of $4,350,000 if figured on revenue and $6,650,000 if figured on allocated fixed capital.[2] Of course, if revenues were adjusted to cover the total costs, they would be much larger; hence the tax figure would be still greater.

[2] This refers to income and surtax only, computed at 40 per cent of a net income of $5,651,000, (that is, $7,740,361 net income as shown in the income statement, less $2,089,336 hypothetical state and local taxes). There is nowhere available the information necessary to compute hypothetical "excess profits" taxes, if any.

Sales and Revenue

Assembled from the fragmentary information of available reports, sales of power by the Bonneville Power Administration have been as follows:

Fiscal Year Ending 6/30	*Bonneville*	*Kwhr Generated Grand Coulee*	*Total*	*Total Kwhr Sold*	*Revenues*
1939	.....	.....	.....	30,077,293	$ 49,835
1940	208,571,158	.....	208,571,158	190,288,057	367,900
1941	.....	.....	.....	848,561,855	1,874,322
1942	.....	.....	.....	.....	5,162,376
1943	2,801,480,400	2,816,955,729	5,618,436,129	.....	11,265,468
1944	3,488,873,992	5,751,520,210	9,240,394,202	.....	20,893,363

What Comes Next?

The 1944 report fully recognizes the temporary character of the present power load. The report says (page 61):

"Although revenue for fiscal year 1944 exceeded $20,000,000, a very substantial proportion of the present revenue is derived from service to war plants and establishments. Of the 1,010,262 kw of total contract demand in active executed contracts, 733,600 kw are in industrial contracts subject to cancellation and an additional 40,850 kw are in very short-term industrial contracts. At the Administration's basic rate of $17.50 per kilowatt-year these cancellable and short-term industrial contracts involve annual revenue of $13,552,875. Under industrial contracts having cancellation provisions the total amount of cancellation or termination payments, assuming cancellations of all the contracts effective as of July 1, 1945, would be approximately $9,200,000."

The income statement shows a minimum of interest charges of $5,141,057 and a charge for depreciation of $2,258,529, making a total of $7,399,586 which must be met; cancellations or no. These fixed charges alone are greater than the total gross revenues last year from all non-cancellable contract sales of power. Very plainly, the end of hostilities is going to bring a major problem to this enterprise.

Recent Developments in Infra-Red Applications

(*Continued from page* 160)

times the heat capacity of the infra-red tunnel. Under these conditions we would expect greater spread and greater production from the gas burner tunnel. However, we know that the elements of safety, cleanliness and freedom of products of combustion, such as we have with infra-red lamps, are difficult to match with radiant gas burners.

We have made an analysis of the infra-red activities and post-war plans of some of the leading utilities. This may be summarized briefly as follows:

1. The majority have expressed the importance of close cooperation with the manufacturers of infra-red equipment.

2. Infra-red inquiries are followed either by an industrial heating engineer, by contact men who cooperate with the manufacturers, or in one instance, by a full time infra-red specialist.

3. Cleveland reports 5100 kw of infra-red connected and Cincinnati 3000 kw. Other utilities made no report or have no record of the infra-red loads added. We have connected to our lines about 4100 kw.

4. Most utilities have either an infra-red laboratory or test lamps at the disposal of their customers.

5. Commonwealth Edison Co. estimates that last year the infra-red ovens in their territory consumed 25,000,000 kwhr. The company further estimates that this is more than ⅛ as much as is used annually by all their display lighting load which was turned off during the present brownout. This is surprisingly close to our own estimates because we estimate a loss of 22,000,000 kwhr in three months of the brownout. At this rate the power used by our infra-red load would approximate about ⅛ of this loss.

In our company we use a report form which was inaugurated in January of last year for the purpose of reporting loads according to application. For instance, the headings include lighting, air conditioning, heating, cooking and others. Infra-red is a sub-heading under heating and at the end of each month these report forms are segregated by application. These reports are filled out by any member of the Industrial Division of the Sales Department and in this way we hope to obtain a rather complete tabulation of loads connected, by application, at the end of each year.

We have been making a survey of industrial customers, using a special card which indicates the flow of material through various stages or processes in the plant, the equipment, its uses and the possible new applications. We have to date completed about 1360 industrial plant surveys and in this group we find that 26.8 per cent are interested in either heat treating furnaces, ovens or infra-red applications.

We also find that these industries expect a decrease of 3.6 per cent in their war load but that they hopefully expect 13.4 per cent increase post-war over pre-war.

We have prepared post-war plans covering activities of the Retail and Industrial divisions. In these plans we have included infra-red as a year 'round activity with provisions to inject a special effort—such as a cooperative campaign—for a period of two months. In this

(*Continued on page* 179)

Objectives and Scope of the T. & D. Committee

By Frank Sanford

Chairman Transmission & Distribution Committee, EEI

A COMMITTEE such as ours should occasionally review its objectives and scope. Our discussions and papers reflect the trend of thinking in the industry and should at all times be abreast of, or a little ahead of, the general problems of its members. This means we must avoid a rigid plan and set of standing committees. In retrospect we may note that the past four years have given us ample opportunity for using this flexibility in our organization. From the vantage point of a retiring chairman, I hope I may be able to crystallize some of the ideas that have guided us and which may serve as helpful suggestions for the next year or so.

In connection with our general policy, I particularly like this statement which is contained in a letter written by Col. Bennion: "The function of our national committees is primarily to collect and make available information on what individual companies have done with respect to a particular subject that appears to be of interest to a substantial number of companies."

The original statement of scope of the T. & D. Committee was published in the EEI BULLETIN, November, 1933:

> "To guide technical and economic developments, to consider the problems and record the progress of electric transmission and distribution systems. (Circuits and equipment from generating stations to point of utilization, with the exception of motors and substation equipment, which was assigned to the Electrical Equipment Committee)."

Changes in Emphasis

We may anticipate that our transmission and distribution systems will soon enter a period of more nearly normal expenditures for growth. We have directed our program policy largely in this direction during the past year. Three general statements of factors affecting the electric supply industry today are particularly applicable to the distribution division and should be impressed on our committee programs, as well as our individual thinking.

1. Our industry is entering a period of more difficult finances for system expansion. Large investments required for expansion and broad improvements will be subject to the most careful scrutiny.

2. In the first few peace years major investment expenditures must be transferred from generation and bulk transmission to substation and lines for general distribution. The job follows moving load from large individual war plants to a large number of services for homes and stores.

3. Electricity is taking over and will continue to carry an increasing share of the burden of running homes and, in rural areas, of operating machinery for food production. Power will replace labor in this field as it has in industrial production.

Two of these statements emphasize again that economics must be combined with all of our engineering and operation planning. But there is another, perhaps newer, point of view that may become increasingly important to us. Because of the lag in general distribution construction during the past four years, these budgets during the next few years will become much larger. Distribution items will account for major parts of the system budgets on many, if not on most, systems.

Transmission and distribution accounts for about 35 per cent of the total investment compared to 45 per cent in generation and major substations. Several millions spent on one major project looms larger, and has often had more executive attention, than the millions spread over the many smaller units for distribution expansion. Now, with the millions needed for general distribution capacity, the 35-45 ratio may appear on budgets in the reverse order of 2 to 1 or more. We may in consequence of these factors find much more need for substantiating studies and data than we have found necessary in the past to obtain the budget approval.

The third of these factors accentuates two requirements in distribution design. (1) The factor of inconvenience is no longer the primary measure of prolonged service interruption. Our continuity requirements for residential and rural service are more and more taking on the aspects of lost operation and production. (2) Our voltage requirements are based on increments and variation of such magnitude that full load currents no longer are the sole guide in design.

The conventional viewpoint of distribution has considered service to the service entrance or meter. Increased attention must be given to conditions all the way to appliances and machines that use the service supply. Our customers judge electric supply by their operations and not by the conditions we may measure at the meter. We must include increasing attention to customer's wiring, and to the characteristics of equipment such as air conditioning and welders. This equipment is entirely outside the 35 per cent of total investment, but all of it may affect this investment directly. For example, we have in the past spent more money per feeder to eliminate flicker caused by refrigerators than is invested in the feeder voltage regulators. Air conditioning can bring a new cycle of fluctuation troubles.

Like the telephone, service extends to the end result of all the parts. Unlike the telephone, a large part of the troubles that may affect the results are beyond our direct control. But because of the measure of results in operation and continuity, we must extend our interest. Whether this interest is directly handled by distribution or by another department of the operating company, it is a part of the broad aspects of distribution engineering.

Measures of Reliability

For a large part of our general urban distribution we may consider the problem of reliability very nearly solved. In fact, we have had some reviews of reliability versus economy that raise the pertinent questions of how much farther we can go in improving service and what we may call tops in performance.

A large part of the total improvement we have made on our systems has been associated with reduction of lightning troubles, improved grounding and arrester characteristics, and better transformer maintenance and clearances. Improvements in fuse characteristics and in fusing practices have combined to reduce fuse operations.

The average residential service system today suffers far more in outages from tree troubles than from lightning. We made our improvements in the one problem with one investment or maintenance

change. We have not found an equivalent way to handle the tree problem.

And we are far from through with the problem of reliability in rural area service. Long lines with low-load densities, lighter construction, greater trouble clearing distances and poorer transmission supply operation records are inherent to the overall record. Rural customers who were anxious to have any electric service are becoming more expectant of continuous electric service. Further load building in food production applications will at the same time add to this requirement.

Our Committee Organization

Two years ago, we made some change in the group sponsor set-up of the committee. General Engineering was a new title adopted to assure more direct attention to papers and reports on load characteristics, densities and similar measuring factors, and general reviews of reliability and economics. It is to this sponsor that we may well assign the subjects relating to appliance tests, fluctuation effects, coordination problems and similar studies. Methods of job training and employee instruction should also be given an increasing amount of attention.

Our former heading of Transmission has been included in the scope of Overhead. At the same time, we have given more attention to the medium voltage transmission lines. It has seemed that the better understanding of lightning protection has been applied more generally to the major lines than to these subtransmission circuits. Overhead subjects for further investigation should also include a broad review of construction methods for distribution in residential districts where tree problems are greatest, and a comparative study of rural line construction and operation.

Our Underground subjects have included the new cable insulations and developments related to the use of gas and oil fill in cable construction. Recently, we have asked those who are accustomed to looking underground at their cables to assist in consideration of aerial cable construction. While this is an Overhead subject in its final application, there are numerous cable problems in the designs and especially with taps and terminals. Broad consideration should be extended by our committee to questions of reliability and economics as well as design and installation.

Consideration of materials and equipment under the heading Standards and Specifications became sidetracked by the emergency heading of Salvage and Substitutes. We are now back to the normal objectives, with activity started by several subcommittees on specific items. It is easy to be pessimistic about the possibilities of standards for our construction needs, but I believe we have in the past made definite contributions to the reduction in diversity of demands and that we can expect further accomplishments along this line. The results must be somewhat of a compromise—we may expect something less than 100 per cent load factor.

Our committee objectives are often served best by assignment of subjects to special subcommittees to obtain joint consideration and action on behalf of our group and the interested manufacturers. This has been particularly true with the standards for distribution transformers, in the study of preferred voltage ratings and for several hardware specifications. Joint studies by our industry representatives and those of the communication interests have been especially helpful to all of us. Assistance of others who are not members of the T. & D. Committee may be called for in these projects, to obtain broadest familiarity with the problem and to secure representative action.

Broader Scope

A revision of wording in the original statement of scope of the Transmission and Distribution Committee will recognize these changes in emphasis and organization. I propose that the scope should state:

"To guide technical and economic developments, to consider the problems and record the progress of electric transmission and distribution systems. (Circuits and equipment from generating stations to point of *and to include* utilization, with the exception of substation equipment, which is assigned to the Electrical Equipment Committee.)"

Our committee has a grand opportunity for service, to our members and to the industry, as we enter a period of renewed interest in load building by many small units to replace load lost in a few large units. We have no particular problem of reconversion in our business of producing and distributing kilowatt-hours. Our major objective in committee activities is to keep alert to the new problems following the change in emphasis and customer interest.

Philip G. Gossler

PHILIP G. GOSSLER, 74, chairman of the board of Columbia Gas and Electric Corporation, and a member of the Advisory Committee of the Edison Electric Institute, died May 18 in New York.

Mr. Gossler played a leading part in the development of the utilities system that now operates one of America's largest networks of gas lines, totaling more than 28,000 miles and owns natural gas rights to approximately 8,000,000 acres of land. About 70 per cent of the company's interests are in gas, although its operating companies spread over New York, Pennsylvania, Ohio, West Virginia, Virginia, Kentucky, Maryland and Indiana, also deal in electricity, water, heat and transportation.

Educated at Pennsylvania State College, Mr. Gossler received a Bachelor of Science degree in 1890, and a degree in electrical engineering in 1892, pursuing a post-graduate course in electrical engineering at Columbia University in 1893.

In 1890-91 Mr. Gossler was employed by the Foundry & Machine Company and the Edison General Electric Company at Chester, Pa., becoming assistant engineer of the United Electric Light & Power Company, New York, in 1891. Four years later he went to Montreal as superintendent and engineer of the Royal Electric Company, and in 1901 became general superintendent of the Montreal Light, Heat & Power Company.

Returning to New York in 1904, Mr. Gossler became vice-president of J. G. White & Co. and in 1909 became chairman of the board of Columbia Gas & Electric Co., of which he was elected president as well as chairman in 1922.

This was the nucleus of the utilities system which was developed under Mr. Gossler's leadership. In 1926 he and George W. Crawford, then president of the Ohio Fuel Corporation, accomplished the merger of the two natural gas systems into the Columbia Gas & Electric Corporation. Mr. Gossler became president of this corporation, later serving as chairman of the board.

Mr. Gossler was also an officer of Columbia's numerous subsidiary or affiliated corporations, now numbering 34 and was a director of the Guaranty Trust Company of New York, and the Morristown Trust Company, Morristown, New Jersey.

Wisconsin Public Service Corp'n Salutes Employees for War Services in Special Report

"PARTICIPATION in the great battles of North Africa, Anzio, Attu, Kiska, Saipan, Burma, Tarawa, Guam, Bougainville and others, the invasion of France, Germany and the Philippines, the crossing of the Rhine, have won for you Purple Heart and Bronze Star awards, and special citations for heroism and gallantry in action."

Thus the Wisconsin Public Service Corporation salutes the men and women from among its employees who have gone overseas to fight the Axis powers. The tribute is made in a publication of the Wisconsin utility titled "Together We Serve," and which is devoted to recognition of the roles played by its personnel both at home and abroad in helping America's drive for victory.

The Wisconsin Public Service Corporation points out that not once has there been a serious failure in its supplying of power to plants in its territory which have been turning out guns and munitions, submarines and corvettes, trucks, airplane parts, batteries, hospital and field kitchen supplies to make American fighting forces the best equipped in the world.

The published tribute makes a survey of what its workers have done both on the war front and the home front, and concludes with a statement of the company's plans for the future. The booklet went to the company's workers and to its men and women now in the armed forces.

The tribute to the men on the war fronts read, in part:

"In answering your country's call in its present war emergency, you left families, sweethearts, jobs—your very way of life—to endure the sickness, hardships and privations of war. Sleeping in fox holes, eating 'K' rations, working and fighting long hours under the most trying conditions—these have been your lot in war times.

"In spite of such sacrifices, your letters home have maintained a note of high morale and cheerfulness—a courage far beyond the call of duty. They have been filled with pictures of foreign lands and customs, of contacts with strange peoples, portraying continued alertness and interest in your new surroundings. Thay have had a sense of humor that is so important when the going gets tough.

"Promotions, devotion to duty, and all your extraordinary achievements are a source of pride to your families back home and to Public Service. These responsibilities and accomplishments form an important step in the speeding of victory on all battle fields.

"Your absence has been deeply felt. The spot in the organization that you filled before you left—your job—is still here and waiting for your return.

"Numbered among you are two lieutenants in the Army Air Corps who are prisoners of war in Germany. It is the hope of every one at Public Service that they and all of you will return home well and safe."

The report also had words of high praise for the employees who stayed at home and fought for increased war production. Says the booklet:

"While the work you have done has not had the drama of the military connected with it, results were still very important and you may take pride in the job you have done here at Public Service. Every effort was made to keep the generators turning, lines in service, gas plants operating, buses running. Every click of typewriter, every stroke of a pen in a clerical or administrative job, have had to do with carrying on to help win the war.

"In spite of working shorthanded and longer hours, you have worked on safely and the past three years have seen no increase in lost-time accidents. You have helped to establish new all-time high records in sales of gas and electricity, number of customers served, bus passengers carried, and gross revenues taken in.

"You have done these things without marring the reputation you have made through the years for high standards of efficient and friendly service. You have not used the war as an excuse for dealing with our customers in a less courteous manner than peace time always demanded.

"Many of you have carried extra work where men who left to join the armed forces were not replaced. Public Service fighting men banked on you and many like you to carry on in the clutches and you came through like a million dollars.

"You have had confidence in yourselves and one another; you have cooperated and worked together when the going was plenty tough; you have remained steadfast in your loyalty to Public Service. Anything that your company has accomplished is directly attributable to the efforts you have expanded. Without your loyalty and perseverance the record would have been impossible."

In examining the prospects for the future, the Wisconsin Public Service Corporation finds that the future of its returning veterans is a major concern. The report declares:

"One of the most important matters relating to employees at the present time are plans for those who have temporarily left the company to go into military service. Every possible opportunity will be provided to permit the returning serviceman to make the fullest use of his training and abilities. All his privileges—group insurance, pension benefits, seniority and others—are to be his with full credit for years in military service.

"Related to the returning veteran are plans for a broader education program, under which every employee wishing to improve himself will be given an opportunity and assistance to do so. The program will include company-sponsored training courses, university extension and correspondence courses, and will make available attendance in off hours at accredited schools."

In conclusion, the company gives its employees a glimpse of its program for expansion to better serve its territory, which the company calls "an excellent balance of diversified industry and agriculture, in addition to being famous as a resort country."

So certain is the company of the future, the booklet states, that it is preparing to invest millions of dollars to provide for adequate services to industry, agriculture and resort areas in the territory. The report to the employees concludes with a statement of earnings for 1944, showing the sources of revenues and how this money was spent.

Fundamentals of Distribution Substation Design

By R. T. Henry
Buffalo Niagara Electric Corporation

Presented before meeting of Electrical Equipment Committee, EEI, Cincinnati, May 17-18.

MOST utility engineers have rather definite ideas regarding the design of distribution substations, and the variation found in such substations certainly proves that there is more than one way to achieve satisfactory results.

However, it is sometimes helpful to go back and take a fresh look at the situation from a fundamental viewpoint to determine whether we are taking full advantage of the possibilities of providing satisfactory service at minimum cost. The distribution substation must be considered in its relation to the transmission system and to the rest of the distribution system since it affects, and is affected by, each of these parts of the complete system and it is important to provide a proper balance between transmission and distribution circuits.

Some of us may remember when it was considered essential to have continuous manual supervision of all power stations and distribution substations. This need for supervision made it necessary to concentrate the distribution substation equipment into a minimum number of substations in order to keep down the cost of supervision. This resulted in large substations supplying large areas with some of the distribution feeders extending for considerable distances from the substation. These long feeders, and the difference in the length of various feeders, introduced some very real voltage regulation problems.

One of the most important developments in the distribution field was the introduction of automatic reclosing feeder equipment. This eliminated the need for continuous manual supervision and offered an opportunity to split up the substation equipment and scatter it throughout the area and to strike an entirely new balance between transmission and distribution circuits.

It was a good many years before the real significance of this was generally realized. Many installations of automatic reclosing feeder equipment were made in large, attended stations where it simply relieved the operators of a little effort. Then when the possibilities were more fully realized there was some tendency to go to the opposite extreme and to scatter very small substations throughout the area with a minimum amount of distribution, but with an excessive amount of transmission.

It is the responsibility of the engineers involved in designing distribution systems to recognize the relation between the transmission system, the substations, and the distribution circuits, and to provide a proper balance between them, keeping in mind the overall economics, reliability of service, convenience of operation and maintenance, and provision for future load growth.

Diagram

Probably one of the most important questions to be considered in the design of distribution substations is the diagram of connections. Should we use a double bus with double breakers, a main and transfer bus with single breakers and transfer disconnects, or a single bus? Should we use a single bank of transformers or multiple banks? Should we use three phase or single phase transformers? Should we provide a high-tension bus or individual high-tension circuits to each transformer bank? Should we use bus regulation or individual feeder regulation?

Obviously the answers to these questions will not necessarily be the same in all cases but will vary with the conditions in different cases.

In urban areas it is rather general practice to supply each distribution substation from two or more separate transmission circuits. There seems to be a definite trend towards omitting the high tension bus. The loading is generally sufficient to justify two or more transformer banks and the use of three-phase transformers is quite general. It is doubtful if double busses and double breakers can be justified in most cases. In fact, there seems to be a trend towards single bus arrangements with no provision for maintenance of the breakers without interruptions except by means of emergency tie switches in the field. We have a definite preference for the main and transfer bus and use it quite generally.

Regulation

Another important question involves the choice between bus regulation and individual feeder regulators. Large substations with long feeders and considerable difference in the length of the various feeders required individual feeder regulators. However, since the advent of automatic reclosing feeder equipment it is generally possible to use smaller substations and to locate them much closer together. This results in comparatively short feeders and in much less difference in the length of the various feeders. This offers an opportunity to take advantage of the economy and reliability of bus regulation. In some cases it may be necessary to use supplemental regulators on a limited number of feeders. Bus regulation often eliminates the problem of short circuit current limitations encountered in individual feeder regulators because larger regulator units can be used and no one regulator is subjected to the total short circuit current since each regulator is in one of the supply circuits.

Physical Arrangement

Another very important consideration is the physical arrangement of the equipment and the choice between indoor and outdoor installations. There seems to be a trend towards the use of outdoor installations, consisting of indoor equipment in metal enclosures. Such structures impose some very real problems in connection with operation and maintenance, particularly in severe climates. There is danger of rusting and corrosion on the inside of the enclosures and in the joints, some of which are inaccessible without completely disassembling the entire enclosure. We have a great many outdoor stations, principally in outlying areas, but we have a very definite preference for conventional outdoor equipment for use outdoors.

For urban areas we prefer a simple building with indoor equipment. The difference in cost is generally not very great and the building offers very real advantages in connection with operation and maintenance. We find that by using neat but simple buildings, with all equipment indoors, we have less difficulty in finding suitable locations, par-

(*Continued on page* 172)

Progress in Power Apparatus Development

By A. C. Monteith

Manager, Industry Engineering Department, Westinghouse Electric & Mfg. Co.

Based on a talk before the Engineering and Operating Committee, Southeastern Electric Exchange, March 23, 1945.

THE enviable record set by the electric light and power industry during the war would not have been possible, except for the progressive thinking done by the industry and its willingness to try new and promising ideas. This industry has been placed under considerable pressure of late, but it should not hesitate at this stage. General Lee summarized the problem in a warning to his Secretary of War as follows: "We must decide between the positive loss by inactivity and the possible risk by action."

In the short time allotted, only a few ideas that are receiving consideration or are being tried can be selected from the generation, transmission, and distribution fields to illustrate some possible lines of action from an engineering point of view.

Turbine-Generator Standardization

Standardization unquestionably is desirable in this industry. One usually thinks in terms of quantity production items for standardization. Turbine-generator standardization is a new field, but a promising one. If a reasonable number of sizes could be standardized, stocking of frames, forgings, castings, and the like would be possible, permitting saving in cost and considerable saving in time of production.

A Joint Committee on Steam Turbine Generators was established by the Board of Directors of the American Institute of Electrical Engineers and the Council of the American Society of Mechanical Engineers to prepare preferred standard ratings and characteristics of steam-turbine generators. The standardization is limited at the moment to 3600-rpm, 3-phase, 60-cycle condensing steam-turbine generators with ratings greater than 10,000 kw. In all of this work, the standards are not considered mandatory but as preferred ratings. It will still be possible to purchase any size, of course, at a sacrifice in the gains expected from standardization. Also, it will still be possible to purchase duplicate machines. In order not to stifle progress, this standard will be reviewed periodically to be sure that it is best fitting the needs of the industy.

The significant features of the standards shown in Table I are:

1. Six standard unit ratings from 11,500 to 60,000 kw, inclusive.
2. One or two standard values of throttle pressure and temperature for each rating.
3. Definite number of extraction openings for each machine, with specified values of saturation temperature at each opening when operating at turbine rating with full extraction from all openings.
4. Specification that the guaranteed capability, in kilowatt output at the generator terminals, shall be 10 per cent above the turbine rating of each unit, instead of the 25 per cent margin usually provided in the past.
5. Specification that the power-factor rating of the generators shall be 85 per cent at the generator rating, yet provide greater kva capacity in proportion to the capability of the turbine than in present designs; also, that the short-circuit ratio of the generators shall be 0.8 at generator rating.
6. The two smaller units will have

TABLE I—SUGGESTED PREFERRED STANDARDS FOR LARGE 3600-RPM 3-PHASE 60-CYCLE CONDENSING STEAM TURBINE-GENERATORS

		Air-Cooled Generator		Hydrogen-Cooled Generator --- Rated for 0.5 Psig Hydrogen Pressure			
1. Turbine rating - kw		11,500	15,000	20,000	30,000	40,000	60,000
2. Turbine capability - kw		12,650	16,500	22,000	33,000	44,000	66,000
3. Generator rating - kva		13,529	17,647	23,529	35,294	47,058	70,588
power factor		0.85	0.85	0.85	0.85	0.85	0.85
short-circuit ratio		0.8	0.8	0.8	0.8	0.8	0.8
4. Throttle pressure - psig		600	600	850	850	850 or 1250	850 or 1250
5. Throttle temperature - F		825	825	900	900	900 or 950	900 or 950
6. Number of extraction openings		4	4	4	5	5	5
7. Saturation temperature at	1st	175	175	175	175	175	175
8. Openings at "turbine rating"	2nd	235	235	235	235	235	235
9. with all	3rd	285	285	285	285	285	285
10. extraction openings	4th	350	350	350	350	350	350
11. in service - F	5th	-	-	-	410	410	410
12. Exhaust pressure - inches Hg abs		1.5	1.5	1.5	1.5	1.5	1.5

	Hydrogen-Cooled Generator --- Operated at 15 Psig Hydrogen Pressure			
13. Generator capability at 0.85 power factor - kva	27,058	40,588	54,117	81,176

Notes: (1) A tolerance of plus or minus 10°F shall apply to above saturation temperatures. (Tolerances shall be unilateral so as not to reduce the spread in temperature between adjacent extraction openings.)

(2) "Turbine capability" is guaranteed continuous output at generator terminals when the turbine is clean and operating under specified throttle steam pressure and temperature and exhaust pressure, with full extraction from all extraction openings.

air-cooled generators, while the four larger sizes will have hydrogen-cooled generators, the latter rated for normal operation with 0.5 psig hydrogen pressure and with 15 per cent additional kva capability above generator rating provided by increasing the hydrogen pressure to 15 psig.

The AIEE Group of the Joint Committee also worked out a generator specication for the standard machines. All of this material will be put in print shortly, and although results cannot be expected instantly, the results will be worth watching.

Exciters

Large turbine generator units can now run for long periods without shut-down. The direct-connected exciter has given a good account of itself, but studies show that its availability record is not as good as the remainder of the unit. A preliminary review of an analysis of the experience with 3600-rpm exciters over a period of service up to seven years shows that most of the reported maintenance work, outside of regular brush maintenance has to do with minor mechanical elements. Greater attention to details in the design will improve the performance of those exciters. The latest 3600-rpm exciters incorporate the results of this study.

A new and interesting application is the use of the ignitron type conversion equipment for excitation supply. Approximately 3,250,000-kw capacity of ignitron rectifiers has been built during the past four years for electro-chemical applications and in the production of light metals. Hence, the ignitron is no longer an untried machine.

For the larger 3600-rpm machines, the problems of building direct-driven exciters become very difficult. At present it does not seem desirable to consider direct-connected exciters for ratings above 300 kw at 250 volts. With a satisfactory source of a-c supply available, the ignitron rectifier offers an excitation system that is simple to operate with maximum reliability and low maintenance and is suitable for long periods of continuous operation. Electronic excitation systems of this type would be equipped with permanently evacuated ignitron tubes. A Westinghouse electronic excitation system has been in use on a 25,000-kva, 3600-rpm synchronous condenser for four years. This condenser has not been shut down because of the exciter in 3½ years. The ignitron tubes installed 3½ years ago are still in service. Any normal maintenance, including the replacement of either of the ignitron or control tubes, can be done with the machine on load.

With this type of excitation, it is necessary to give special consideration to the source of supply. Any drop in system voltage results in a corresponding drop in excitation voltage. The effect of voltage drops can be compensated by series compensators in the electronic excitation system and by raising the a-c supply voltage to the ignitrons and increasing the angle of delay in the firing circuit. To study the large and varying number of conditions that can be imposed on an excitation system, a setup was made in East Pittsburgh laboratories where encouraging results were obtained.

High-speed response is easily obtained with this excitation system, and if extremely high speed is desired this can be obtained with an electronic voltage regulator.

Another electronic excitation unit is being built for use on an existing large capacity 3600-rpm turbine generator. The electronic excitation system costs appreciably more than a direct-connected or separate M-G set. Also, it is not suitable for all excitation applications. It is proposed to give this latest electronic excitation unit a complete test in our High-Power Laboratory before putting it into power plant service. All of the results to date are very encouraging. Probably its applications will be limited in number in order to work out all of the minor development items before extensive use is made of it.

Silicone Resins

Insulations good for higher temperatures and adverse moisture conditions are in the news. The silicone resins developed by the Dow-Corning Corporation show much promise. The Westinghouse development of HTS insulation has been carried out in parallel and in close cooperation with the Dow-Corning silicone resin development. Silicone varnishes are available in forms similar to the usual varnishes used by the electrical industry. They have been used with mica, glass, and asbestos to produce high-temperature insulations.

The improved thermal endurance can be utilized in a number of important ways in the design of electrical equipment, such as reduction in size and weight of electrical equipment, increased service life for conventional size and weight, and operation in ambient temperatures materially beyond limits permissible for usual types of insulation.

A few cases of power-plant operation justify trial of the HTS insulation. One is for motors driving induced draft fans subject to high ambient temperatures.

At present quantities of silicone are limited and they cost approximately eight to ten times that of the good insulating varnishes. Much is still to be learned about methods and processes of handling and manufacturing processes which will have to be changed to apply it generally to lines of equipment. We are trying a few applications to draft fans.

Gas Turbines

One of the most intriguing possibilities in a number of fields is the much talked about and publicized gas turbine. The principle of the gas turbine is very old. Its practical applications rest on the development of high-efficiency compressors and turbines and materials suitable for service at much higher temperatures than we normally think of in a steam cycle today. Figure 1 gives the approximate relationship between several assumed top gas temperatures and the expected thermal efficiency of the open cycle. A long-life unit is now believed practical at about 1200° F where the cycle of efficiency may be of the order of 19 to 20 per cent at the optimum pressure ratio of six. The maximum output of the simple single turbine open cycle unit is now about 7500 kw or even less. Of course, the thermal efficiency can be improved by making the cycle more elaborate, but this requires considerably more development work than involved in the initial step for the open-cycle gas turbine.

Uses for this device in the aviation and transportation fields are conspicuous, but we believe its application in the central-station field is still somewhat limited. Before it will receive broader use in the central-station field, it will be necessary to develop metals able to withstand still higher operating temperatures. It may be necessary to learn how to use coal instead of oil, and it will be necessary to make the cycle more elaborate before it will be a competitor with the very efficient steam cycles now developed. Of course, some special applications can be considered in the central-station field, such as for peak load or stand-by service.

Transformers

One of the most noticeable trends in transformer design over the past 20

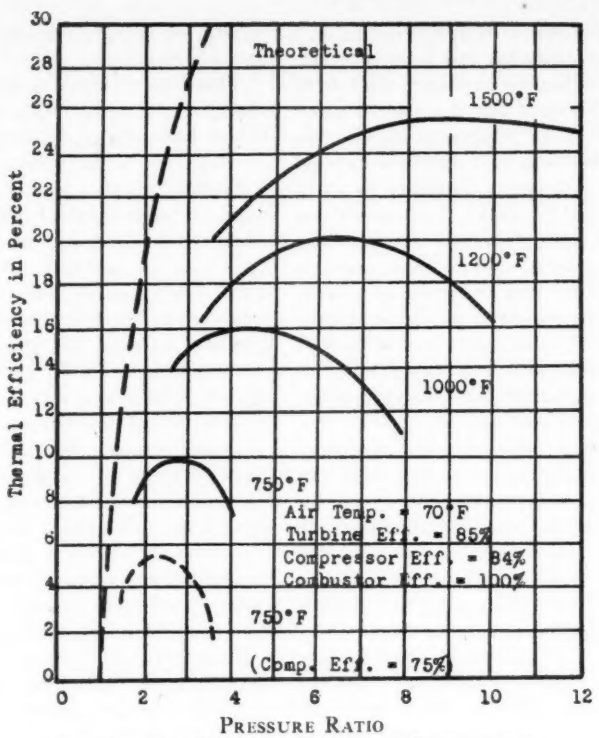


FIG. 1—GAS TURBINE THERMAL EFFICIENCIES

years has been the more general use of three-phase transformers. Some idea of this can be gained from a few random but representative figures. In the 20's we were building approximately seven per cent of our output in the small power transformer field; in 1936 this had increased to 60 per cent; in 1940 to 75 per cent, and so far in 1945 we have sold 84 per cent of our transformers as three-phase banks in this field. Three-phase transformers have some obvious advantages: initial costs, installation costs, and maintenance costs are all lower. Losses also are somewhat less than for the corresponding single-phase bank of transformers. It has the disadvantage of losing the whole bank in case of failure, but system inter-connections have given a reserve in case of an outage on the bank. Portable substations also have provided ready spares for the smaller sizes.

The modern transformers, however, have considerably improved reliability over previous transformers. The factors that will be outlined later apply not only to three-phase but also to single-phase transformers, but these are arguments in favor of having a greater degree of confidence in three-phase transformers than we might previously have had. A few of the salient points contributing to greater reliability of modern transformers are:

1. Better understanding of design features, especially those involving surge strength of transformers.

2. Better understanding of the characteristics of natural lightning.

3. Better protective devices and better protective schemes.

4. Better mechanical features in the tank seals, mechanical parts, bracing of conductors, and the like.

Figure 2 illustrates some of the trends in connection with the improvement of insulation strength to surges over the past 20 years. It is seen from this figure that modern arresters with modern protective schemes limit the surge voltages to approximately one-half the surge strength of transformers, while the degree of protection provided to transformers prior to 1930 was open to question. The curve also shows that modern arresters with modern protective schemes give a fair degree of protection to some of the older transformers.

Some might ask how do we know that the theoretical strengths are built into the transformers and that the human element in the building of such does not impair the expected performance? It is true that on paper a design might be perfect, but if it is not built according to the design then there can still be trouble. Our experience with impulse testing over the past years has indicated that this test has brought out more of these human errors than any other test we have had. This has so impressed us that we have now installed a 3,600,000 volt generator in the production aisle and are submitting all of our power transformers to impulse test as a check on the quality of the product. The routine test incorporates two front-of-wave tests with 1000 kv per micro-second rate of rise, and two full wave tests with normal excitation provided. The severity of test is as close as possible to the ASA full wave standard values and NEMA front-of-wave for the particular insulation class. These tests were selected as the most practical after reviewing tests on 6,000,000 kva of transformers tested in our laboratory at Sharon. Seventy per cent of the insulation failures have resulted from difficulties in the materials, in processing or in workmanship. The bulk of these difficulties required only minor corrections for replacement of the faulted part for the transformer to pass test. In a few cases design alterations were necessary. Without impulse testing, few if any, of these defects would have been discovered.

The extension of impulse testing power transformers for quality control is a logical step. It is effective, economical, and lends itself to production testing. Further experience will show how to simplify and expedite quality control testing, maintaining at the same time its full effectiveness in assuring power transformers of highest quality.

Air-Cooled Transformers

One of the most important new developments is the large dry-type air-cooled transformer for indoor applications. This transformer originally designed for central-station use has found broad use in such applications as indus-

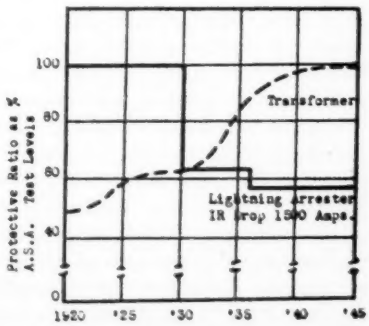


FIG. 2—LIGHTNING PROTECTION OF TRANSFORMERS

trial plants, office buildings, mines, chemical plants, and other indoor applications. These transformers have made possible the installation of power supply and complete substations indoors at the center of the load, resulting in the most economical system of power distribution. This transformer is different from the old air-blast transformer in that its insulation is principally air, porcelain, glass, and materials containing a minimum of combustible substance. Air-cooled transformers have less heat-storage capacity but they are insulated with Class-B insulation, which is not as critical to temperature as Class-A insulation used in liquid-filled transformers. A number of air-cooled transformers have operated at 150 to 250 per cent load for more than 24 hours at a time without interruption of service and with little or no deterioration in insulation. Approximately 2000 air-cooled power transformers are in service, totalling more than 1,000,000 kva in ratings up to 4000 kva and 15,000 volts. Many of them have been in continuous service for as long as seven years. Though many of them have been operating under most severe conditions, none has failed as a result of ills that one would associate with air-cooled apparatus; that is, moisture, high humidity, vacuums, accumulation of dust or dirt, or excessive winding temperature.

The air-cooled transformer allows the building of indoor substations completely dry when applied in combination with air interrupting devices. A totally-enclosed dry-type transformer has been built and is in service and designs have been worked out for dry-type transformers that will allow partial submersion. These features will mean much in the application of this device to network systems.

Circuit Breakers

The trend is decidedly towards the use of air-blast circuit breakers for indoor heavy power-station switchgear. This type of breaker lends itself well to installation in standardized metal-clad switchgear. Incidentally, this is a good example of where effort in connection with standardization has certainly shown results during the war. Eighty per cent of the switchgear built during the last two to three years has been along standard lines as outlined by the standardizing committees. It has allowed reductions in prices even in the face of increased costs.

The pressure to eliminate oil in outdoor substations has not been so great. A few installations have been made with air-blast breakers but the general practice is still to use breakers of the oil type. Improvements in these breakers have no doubt slowed up any tendency to go to outdoor air breakers. Just recently a new line of high-voltage breakers has been developed that allows approximately 50 per cent reduction in oil content of the breaker, results in higher speed of arc interruption and of overall clearing time, and lends itself better to reclosing duty cycle of either the three-pole or single-pole type.

This type of oil circuit breaker is now available for voltages ranging from 115 to 230 kv with interrupting capacities from 1,000,000 to 3,500,000 kva. It interrupts the power arc within five cycles on a 60-cycle basis and is suitable for fast reclosing. The breakers are operated by pneumatic mechanisms, although the conventional solenoid can be used if necessary. Reclosing times are available down to 20 cycles on a 60-cycle basis and tests in the High-Power Laboratory show that the breaker performance on the second interruption is the same as on the first, indicating that there is no loss of interrupting ability because of the gas remaining from the first interruption.

This line of breakers has been completely tested up to rating in the High-Power Laboratory. Although the rating of this line is at present limited to 3,500,000, inquiries indicate that in the relatively near future 5,000,000 kva or whatever the next step may be is more than just a possibility. As previously stated, the standard line of breakers is rated on a 5-cycle opening time basis. However, designs for three cycles are also available in 138 kv and higher voltage for 3,500,000 kva.

A review of developments has always been inspirational. We hear many who say the electric light and power industry has reached a saturation point. In over twenty years of contact with this industry, I would say that there are more possibilities for advancement today than twenty years ago. There are many new developments on the horizon for load building and there are many thoughts on new schemes of supplying these loads—new improvements in prime movers and transmission. There is still plenty to do by the users and manufacturers so let us follow General Lee's advice and make mistakes by action rather than suffer in all respects by inactivity.

Substation Design

(*Continued from page* 168)

ticularly in areas where noise is a problem.

We find that very real savings can be made by careful consideration of the arrangement of the equipment, particularly in connection with aisle space. In many of the older stations more than half of the total space is required for aisles and passageways. Even some of the modern switching structures require aisles on both sides whereas, by careful designing, it is often possible to arrange the structure so that an aisle is required on one side only. Considerable savings can often be made by arranging the various apparatus on both sides of a common aisle.

Another scheme which we have used to advantage is to arrange the various apparatus in parallel lines to facilitate extensions and to build only the sections of building and structures required at the time, and to arrange for extensions in sections or units somewhat like a sectional bookcase. This offers a good opportunity to provide fire walls between units of a station to limit the extent of damage and disturbance in case of a fire.

Buffalo Distribution Substations

A good example of the application of these ideas is the typical distribution substation design used in Buffalo. These substations are of unit type construction. Most of them have three or more units with provision for additional units as required. The units in each substation are supplied from separate transmission circuits with no high tension bus. Each transmission circuit supplies similar units in several other substations. The transformers are paralleled on the low tension side only and the regulators are in the transformer circuits to provide bus regulation. The number of units installed in each substation is such that one unit can be taken out of service at any time without interrupting any load. The low-tension switching consists of a sectionalized main and transfer bus which provides for maintenance of breakers without interrupting any feeder and without involving any switching

(*Continued on page* 180)

Crossarm Loading Studies

By H. F. Ostman

Union Electric Company of Missouri, St. Louis, Mo.

Presented before meeting of Transmission and Distribution Committee, EEI, Cincinnati, May 14.

IN the past the required section of a crossarm has often been determined by applying the heaviest vertical loadings anticipated, multiplied by the required safety factor, and the stress at the weakest point calculated. Frequently the calculation was based on a balanced load, the effect of the braces being excluded and merely regarded as an added margin of safety. The use of any given type of crossarm brace was largely a matter of individual judgment and tended in the "heavy" direction.

Recently it became desirable to establish greater uniformity in the application of arms and braces for various load conditions, a situation that made it apparent that the above method of approach needed revision.

Summary of Findings

Realizing that heavy continuous loading resulted in failures without approaching the allowable stress a study was made to set up the fundamental data required for a solution of the problem. The findings can be summarized as follows:

1. The load a wood member can carry is a function of the *duration* of the load as well as the allowable stress per square inch. This has been demonstrated by the Forest Products Laboratory and becomes important in regard to crossarm loadings when it is considered as an example that for a 4/0 W.P. conductor under Heavy Loading the ratio of the vertical loaded to unloaded conductor is approximately 2, while for No. 6 W.P. conductor it is about 5.5. This means that the unloaded conductor in the former case from the standpoint of load *duration* has a more serious effect on the arm and its braces than in the case of the No. 6 wire. Also, here is the problem of supporting loads such as transformers, switches, horizontal deadends, etc., where a continuous application of a fairly constant load is involved.

2. The Forest Products Laboratory has demonstrated that a clear green wood member supported as a beam will fail under a "Continuous" or long time load at 9/16 the short time or "Test" load value.

The strength of various crossarm and brace assemblies was checked by calculation for both types of loading and it was found entirely practical to establish Vertical, Horizontal and Transverse load limits for crossarms supported by light Flat wood braces (fastened to face of pole and side of arm), "V" type wood braces (fastened to face of pole and under the arm) and Heel or Knee braces (fastened to side of pole and under arm). The load limits were established for the above "Continuous" loading and for "Intermittent" loads which are not strictly comparable to "Test" loads since the time element is longer.

3. The difference in effectiveness of the three types of braces in helping the crossarm support vertical loads is marked and allowed definite standards to be set up for their use. This resulted in a smaller number of standard arms and braces.

Safe Vertical Loads on a Crossarm

Before discussing the methods used in establishing standard loads for a given crossarm and brace assembly it might be well to review briefly the behavior of wood under "Continuous" and "Intermittent" loads.

The Forest Products Laboratory has demonstrated that a load continuously applied for several years to a wood member will cause failure if it is 9/16 of the "Test" or short time load. In this study, the 60 deg. F loading was decided on as the "Continuous" loading while loadings resulting from wind and sleet were termed "Intermittent" as they lie between the "Continuous" and the short time or "Test" loads.

In addition to the above factor, a variability factor of 3/4, and a safety factor of 3/5 is applied by the Laboratory to the ultimate fiber stress of a clear green specimen of the species under consideration. The resulting fiber stress is known as the Basic Stress. To arrive at the allowable Working Stress the Basic Stress is multiplied by factors set up for such variables as: slope of grain, knots, shakes, checks, alternately wet and dry conditions, etc. Using the above it would appear that the allowable Working Stress for vertical loads in the EEI TD-61 1940 specification for Type A Fir Arms is between 1000 and 1300 lbs./sq. inch depending on where the section is taken and is not much different for Type B arms.

For Intermittent loads it was found that multiplying the allowable Continuous load by three for Vertical and Transverse loads and by two for Horizontal Deadend loads gave joint or arm stresses that were quite conservative.

The procedure followed in analyzing a crossarm assembly consisted first in calculating the strength of each joint as per methods shown in the "Wood Handbook" and Bulletin 597, both published by the United States Department of Agriculture. After having determined the weakest joint in the assembly a structural analysis of the whole assembly was made and an external "Equivalent" load applied four inches from the end of the arm such that the resulting stresses were within the limits of the weakest joint. The "Equivalent" load is a load obtained by taking moments (using each pin load) about the through bolt of the arm. This "Equivalent" load cannot be substituted for the pin loads when a stress analysis of the joints is made (exception two wire circuits carried on end pins) since the effect of the braces is to change the through bolt loading depending on where on the arm the conductors are placed. It does, however, afford a quick and sufficiently accurate means for the engineer to convert the loads from several wires on one side of the arm (the heaviest loaded side is always used) and check this value against the established standard loads for the several arm and brace assemblies and so determine which assembly is to be used.

A few values for joints may be of interest. The long time load on a ½ x 4 inch lag screw joint in Western Red Cedar was calculated as 500 lbs. with an intermittent loading of 1500 lbs.

TABLE I

Crossarm	Number of Arms	Type Wood Brace	Equivalent Continuous Load V	H	T	Equivalent Intermittent Load V	H	T
3¼" x 4¼" x 8'-0"	Single-with pins	Flat	125	170(1)	400	375	500(1)	1200
3¼" x 4¼" x8'-0"	Single-with pins	V	300	170(1)	400	900	500(1)	1200
3¼" x 4¼" x 8'-0"	Double-Dead End	Flat	250	800	800	750	1600	2400
3¼" x 4¼" x 8'-0"	Double-Dead End	V	600	800	800	1800	1600	2400

[1] The loadings given under this note are the loadings per pin and are applicable to the maximum number of pins on the arm.

while the ⅝ x 5 inch lag screw used to fasten a "V" brace to the pole had a long time loading of 800 lbs. with 2400 lbs. as the intermittent loading. It should be noted that originally a ⅝ inch machine bolt was used for this fastening and although stronger than the ⅝ x 5 inch lag screw, tests as well as calculations indicated that the extra strength would rarely if ever be used.

Tests on assemblies of arms and braces using the data established by the methods discussed showed little or no distortion or movement of a unit when subjected to the standard "Continuous" loading. At "Intermittent" loadings arm deflections could be measured but on release of loads each assembly returned to its original position. Loads at which failure occurred were considerably in excess of two times the Intermittent loads and were always accompanied by considerable structure distortion and consequent redistribution of stresses. The materials used in several tests were salvaged items about 10 years old in order to check the effect of the standard loads under these conditions. No changes in load assignment could be justified from this standpoint.

In Table I are listed "Equivalent" loads for some 8-foot crossarm assemblies. Vertical (V), Horizontal (H) and Transverse (T) loads are given. The two latter will be discussed further.

Safe Horizontal Loads on a Crossarm

These can be divided into two parts. Those where deadending is done on pins and the others where done on double arming bolts.

It was quite difficult to establish by calculation Continuous and Intermittent loads for deadends on insulators held by steel shank type pins since the splitting effect in the arm was influenced considerably by the pin base area in contact with the top of the arm. The loads per pin finally established of 170 lbs. for Continuous loading and 500 lbs. for Intermittent Loading were largely the result of tests and as a by-product pin specifications establishing definite minimum base areas were prepared. Also crossarm specifications with flat or unroofed arms were established.

In Horizontal Deadends on double arms spacer bolts were used to truss the arms together. In establishing Equivalent loads for this type of construction the same methods were used as previously described insofar as permissible unit stresses were concerned. However, in checking the permissible loads so established against those obtained by the method outlined in the NELA Overhead Systems Reference Book quite a discrepancy existed. The latter were considerably higher and in some instances would cause failure if our approach was correct. This was confirmed by tests to destruction on double arms which agreed quite closely with the calculated values and also with calculated loads obtained by adding the strength of two single arms together and allowing an additional 30 per cent for the truss effect of the bolts. This method is suggested in Seelye-Electrical Distribution Engineering.

Test results showed little difference by varying the number of spacer bolts in a double arm and showed further that considerable deformation in the bolts took place before failure occurred. With increased spacing between arms this deformation became more pronounced and we believe would tend to eliminate increased truss action as would theoretically result by the NELA method of calculation. Failures occurred at or near the through bolt on the tests made and varied in that the back arm failed first in some tests and the front arm in others.

Safe Transverse Loads on a Crossarm

In this type of load the limits established resulted either from the pins which have a continuous load of 170 lbs. (340 lbs. on Double Arms), or if the number of conductors on the arm was sufficient, by the permissible load on the through bolt which it was assumed would carry the full horizontal component. The loads assigned are calculated, no tests having been run as yet to determine the effect on the through bolt. However, putting the loads assigned in terms of conductors gives results that are in line with past experience.

Arkwright and Mitchell

(*From the Atlanta Journal*)

"WE surmise that the slogan of the Georgia Power Company, 'A Citizen Wherever We Serve,' had its inspiration in the deeds and the preachments of the man who has been for so many years its president and directing genius. Certainly Preston S. Arkwright has given highest priority of his time, energy and gift of leadership to his community, his state and his country. He has participated in all good causes for civic and social progress; in many of them he has been the moving spirit; in some, he has taken hold, when none else could be persuaded, and has turned a forlorn hope into success.

"No citizen can fail to be gratified at the advancement in rank which has come to Mr. Arkwright in his elevation to chairmanship of the board of the great and growing company, in the hope that the burdens may be somewhat lightened to his shoulders while the scope of his authority will be broadened.

"To William E. Mitchell, his successor as president, will go the best wishes of the community. In his nearly 20 years as an Atlantan he, too, has manifested the highest ideals of citizenship as well as outstanding ability as an engineer and executive.

"The team of Arkwright and Mitchell will carry on at the head of the Georgia Power Company. Only the titles of office have been changed and redistribution of duties effected in their elevation."

(*From the Atlanta Constitution*)

". . . In every community there are certain men who help pull the community load. No man has done more of the pulling than Preston Arkwright. William E. Mitchell always has been ready to be hitched beside him. Atlanta and Georgia will rejoice that they are to continue together."

Accountants Meet—Chairmen Discuss Work of Committees

By H. C. Hasbrouck
Accounting Director, EEI

RESTRICTIONS on travel prevented the scheduling of the usual spring joint accounting conference, but the Accounting Division General Committee of the Edison Electric Institute and the Management and Advisory Committees of the Accounting Section of the American Gas Association, which correspond in function and personnel pretty closely with the Institute Accounting Division General Committee, got together on May 22, 1945, at the Hotel Biltmore in New York City to discuss problems of interest to utility accountants.

The morning session was devoted to reports by the chairmen of the various committees and subcommittees carrying on the work of the accounting groups of the two associations. These were progress reports in the main, but indicated a great deal of constructive work had been done and that more is under way. Results of some of these studies have been released for use of those interested and other reports will be so released later. Where two cooperating committees of the Institute and the Association respectively are working jointly on studies or projects of common interest, the report was made by one or the other of the two co-chairmen as arranged beforehand.

Taking charge of the proceedings at the morning session were: H. R. Fianegan, Philadelphia Electric Company and H. H. Scaff, Ebasco Services Inc., chairman and vice-chairman respectively of EEI Accounting Division General Committee; C. E. Packman, Middle West Service Company, and E. F. Embree, New Haven Gas Light Company, chairman and vice-chairman respectively of the AGA Accounting Section, and H. C. Hasbrouck, Accounting Director of EEI.

General Accounting Committee

The first report was rendered by W. D. Virtue, Public Service Company of Colorado, chairman of the AGA General Accounting Committee, speaking also for H. P. Taylor, Wisconsin Public Service Corp. chairman of the corresponding Institute committee. He mentioned studies or reports in progress as follows:

1. Subcommittee on Employee Personnel. This covers such matters as vacations, sick leave, guaranteed annual wage, re-employment of returning veterans, and wage and salary plans. The subcommittee is expected to meet in June and this report will probably be ready in two or three weeks.
2. Subcommittee on Uniformity of Accounting Codes. There is some question whether the time is ripe to offer any thorough-going revisions of existing regulatory codes, and it is uncertain whether any significant recommendations will be made by this subcommittee this year. It expects to hold a meeting in June.
3. Subcommittee on Simplication of General Accounting Procedure and Machine Application. This subcommittee has gathered data on the use of accounting machines which it will discuss at a meeting, probably in June.
4. Subcommittee on Payroll Accounting. This committee has several reports in preparation on various phases of payroll accounting which will probably be completed within another month.
5. Subcommittee on Pension Accounting. The discussion of this subcommittee has emphasized accounting for past service costs and the impact of tax regulations on pension expense. No report is yet ready.

Mr. Virtue mentioned a proposed subcommittee on Functional Accounting. Some investigation is now under way among those interested in this subject, looking to the possible organization of such a subcommittee for further study.

A joint meeting of the General Accounting Committees of the gas and electric groups is in prospect for June.

Customers' Activities Committee

W. A. Kelly, Consolidated Gas Electric Light and Power Company of Baltimore, chairman of the EEI Customers' Activities Committee, stated his committee had held three joint meetings with the corresponding groups of the Gas Association, the first in the fall of 1944, the second in January, 1945, and the third in April, 1945. Seven subjects dealing with various problems of customer activities in the accounting field were selected for study and reports on nearly all of these are about ready for distribution.

J. H. W. Roper, Washington Gas Light Company, chairman of the Customers' Accounting Committee, AGA, mentioned two reports which had been completed, or nearly so, one on new developments in business machines for customer accounting; the other summarizing advantages and disadvantages of various plans of customer bookkeeping. Another report dealing particularly with bookkeeping procedures relating to merchandise sales will be carried over into the fall, when it is hoped a report will be prepared outlining a new plan of merchandise bookkeeping, including a discussion of the use of coupon books for installment sales.

C. E. Rowe, Consumers Power Company, chairman of the AGA Customers' Collection Committee, referred to a report dealing with a complete credit and collection plan having special reference to customer attitudes. This report is expected to be ready in June. His committee is also studying the subject of losses from uncollectible bills and may have a report ready soon on this subject.

J. Gordon Ross, Rochester Gas & Electric Corp., chairman of the AGA Customers' Relations Committee, said his committee is developing two subjects. One report is nearly completed on customers' reactions to utility practices, outlining the things which cause customer dissatisfaction and those which receive customer approval. Another report on credit procedures is about ready for release. It shows great diversity of opinions and practices, particularly on such matters as the use of deposits and the insistence on signed applications for service. Mr. Ross recommended more attention to credit procedures by utilities and greater uniformity of practice, in line with the policy of most unregulated business. He urged that credit procedure start with the assumption that the customer is honest, and management should be careful to avoid any apparent implication that many or most customers are crooks. The report on credit procedures will also deal with the subject of special concessions to veterans.

L. A. Mayo, The Connecticut Light and Power Company, chairman of a joint Committee on Customer Activities and Procedures which had been formed to review existing practices affecting customer activities and endeavor to formulate some comprehensive recommendations for achieving better administrative control and reduced costs stated a ques-

tionnaire had been prepared and copies distributed, some of which had been returned with answers. He urged all who could to complete and return their questionnaires as soon as possible, and expressed the hope a report could be completed by next fall.

Materials and Supplies Committee

T. W. Ayton, Indianapolis Power & Light Company, chairman of the EEI Materials & Supplies Committee, reporting also for O. H. White, Central Illinois Public Service Company, chairman of the corresponding AGA committee, told of successful meetings held, one last September and another in May. He said a plan to invite the cooperation of associate members from companies not represented on the regular committees had worked well, stimulating interest, giving service to smaller companies, and establishing contacts with West Coast utilities not previously taking part in the activities of his committee. He suggested associate memberships might prove useful for other committees.

Three studies have been completed, summarizing information obtained from questionnaires, and will soon be ready for distribution: "Arrangement of Warehouse and Storage Grounds"; "Charging of Minor Items Direct to Plant or Expense Without Clearing Through Inventory"; and "Ordering, Handling, Disposition and Control of Stores Material." A fourth on "Accounting for and Control of Tools" is planned but will not be completed until after the close of the current administrative year. The committee has also undertaken the preparation of an annual brochure on "Helpful Hints for Better Storekeeping." The first number of this series is expected to be forthcoming soon.

The May meeting of the Materials & Supplies Committee in Chicago lasted two days. Papers presented and discussed included: "Stock Control" by B. T. Adams, General Storekeeper of the Illinois Central Railroad; "Stores Procedures of Public Utilities from the Viewpoint of the Public Accountant" by C. D. McDaniel, Arthur Andersen & Company; "Effect of General Accounting Procedures on Stores Accounting"; and "Materials and Supplies Stock Numbering System" by J. M. Imlay, Washington Gas Light Company. Also presented were three papers on interrelated subjects entitled respectively: "The War Has Helped Purchasing"; "The Purchasing Outlook for Electric Utilities"; and "Surplus Property Activities," by R. W. T. Purchas, Middle West Service Company. Other topics discussed were: Insulating Oil Reclamation; Scrap Classification for Utilities; also Salvage Accounting Systems and Store and Salvage Costs, introduced under the sponsorship of K. C. Campbell, The Detroit Edison Company.

Mr. Ayton spoke highly of the work performed by R. S. King, Union Electric Company of Missouri, vice-chairman of the EEI Materials & Supplies Committee, expressing the hope Mr. King would be able to carry on as chairman of the committee for the next administrative year, thus preserving the continuity of the committee's work under an experienced and hardworking chairman.

Taxation Committee

Frank Freer, Jr., Public Service Electric & Gas Company, chairman of AGA Taxation Committee reported also for R. M. Dodds, Ebasco Services Inc., chairman of the corresponding EEI committee, stating there have been three joint meetings of the two committees held in January, February and May. The meetings took the form of round table discussions for the exchange of experiences and ideas. Several reports have been prepared and are available for interested parties, but because of their technical and voluminous character they were not presented or mentioned by Mr. Freer. The AGA Taxation Committee has prepared a report on "Income and Excess Profits Tax Accruals" which was published in the May issue of the *AGA Monthly*. Another joint meeting is expected to be held in September or early October.

Property Records Committee

C. A. Locke, Kings County Lighting Company, chairman of the AGA Property Records Committee, spoke for himself and A. V. Schwartz, chairman of the Plant Accounting and Records Committee of EEI. Through correspondence and conference the committees found that while property record systems show great diversity, as might be expected, there is a tendency toward a more generally uniform pattern. The most important objective is simplification and elimination of over-refinement. In the latter part of June it is planned to hold a meeting at which a draft for a report comparing methods and recommending practical shortcuts can be finally approved for distribution.

Depreciation Accounting Committee

In the absence of F. B. Flahive, Columbia Gas & Electric Corp., chairman of the EEI Depreciation Accounting Committee, H. H. Scaff, vice-chairman of the committee, told briefly of the decision to continue this committee in the Accounting Division, although AGA has discontinued its similarly entitled committee. Only one meeting has been held, in response to a request from the Board of Directors of the Institute, for an analysis of and comment on the 1944 report of the Depreciation Committee of the National Association of Railroad and Utilities Commissioners. After considerable discussion the committee agreed generally on the nature of the reply to the Board of Directors which Mr. Flahive will transmit orally at the next Board meeting. The feeling among committee members was that not much more could be accomplished by the committee at this time but it should hold itself in readiness to advise the industry as new aspects of depreciation accounting arise from time to time.

Application of Accounting Principles Committee

R. P. Kaesshaefer, American Water Works & Electric Company, chairman of the new Committee on Application of Accounting Principles of EEI reported briefly on the organization and functions of this committee and stated its scope as follows:

"To keep informed of the development of accounting principles, conventions, and practices in the accounting profession, with special reference to their application to the accounting requirements of the electric utility industry;

"To promote understanding and unanimity of opinion within the industry regarding the application of these developments;

"To serve as the point of reference when opinion is desired regarding the application to the electric utility industry of accounting changes proposed in bulletins of the professional accounting organizations, rulings of regulatory authorities, or other sources."

The committee's first task has been to deal with a proposed ruling by the Securities and Exchange Commission covering an amendment to Rule 5-03 of Regulation S-X. The amendment relates to the method of showing in published reports "non-recurring or extraordinary" items, especially adjustments resulting from income and excess profits taxes. This subject matter is highly controversial and in part has been discussed in Accounting Research Bulletin No. 23 issued by the Committee on Accounting Procedure of the American Institute of Accountants in December, 1944. The Committee on Application of Accounting Principles has had one meeting and a draft for comments addressed

to Mr. Werntz, Chief Accountant of the SEC, has been circulated among the committee members.

Luncheon Session

The morning session adjourned for a brief recess followed by luncheon. During luncheon Mr. Flanegan, who shared with Mr. Packman the responsibility for the joint meeting, introduced H. C. Hasbrouck, recently appointed Accounting Director of the Institute, saying Mr. Hasbrouck would in turn introduce the guest speaker for the luncheon since he was a friend and neighbor of Mr. Hasbrouck and had consented to speak to the accountants at the latter's request. Mr. Hasbrouck briefly acknowledged his own introduction, expressing his pleasure at working not only with but for his old friends among the utility accountants and said that since their accounting problems were largely identical he would be serving the gas utility accountants in only less degree than those of the electric light and power industry. He hoped he would be able to make the contribution of the accountants to the success of the industry even more effective in the future than in the past. The guest speaker was then introduced as Lawrence A. Appley, Vice-President of the Vick Chemical Company in Charge of Personnel Planning and Research. During about three years between 1941 and 1944 while on leave of absence for civilian war service, he was, first, consultant to the Secretary of War on civilian personnel; later, Director of the Placement Bureau of the War Manpower Commission; and, finally, Executive Director of the War Manpower Commission, reporting directly to Mr. McNutt.

Management and the White Collar Worker

Mr. Appley spoke on "Management and The White Collar Worker," a subject which is engaging an increasing amount of attention of accounting—and other—executives, in a clear and forceful presentation which held the rapt attention of his audience. He made a plea for more energetic and intelligent interest by management in the situation which presently confronts the office worker, and for sympathetic efforts to improve that situation.

Mr. Appley said that, generally speaking, the office worker likes his job better than the production worker. He finds it more interesting than assembly line work and feels he is closer to management and has more chance than the factory worker to move up into the executive class. Today, however, he is under conflicting pressures. He is told by politicians that he can get everything he wants and more if he will vote the party line. He is told by the leaders of organized labor that the union is the one agency that can help him. And he is told by management, but not effectively enough, that his employers are even more anxious to improve his earning capacity. These three pressures are operating with unusual vigor now because of the squeeze in which the office worker finds himself between salary restrictions stabilization and the increasing difficulty of maintaining, to say nothing of improving, his standard of living under the impact of rising taxation and living costs. Management should appreciate this and make energetic efforts to find ways to give justifiable salary increases. Too many executives have been satisfied just to say to their office staff—"Sorry, we should like to pay you more, but the government won't let us."

However, while cash compensation or the lack of it is an immediate cause of the office worker's present unrest and of such tendency as exists toward organization as the best if not the only way to get what such a worker feels he is entitled to, it is by no means the only thing management needs to think about in its relations with subordinate office workers. Mr. Appley mentioned, with illustrations, at least six points that management ought to consider as part of its responsibility toward its "white collar workers" and as a part of its duty to maintain an effective organization.

First, he said, every job should be well defined and clearly described so each worker should know precisely the limits of his responsibility. Second, there should be definite standards of performance for each job. Third, at reasonably frequent intervals there should be a review of each worker's attainments and an interview between him and his superior, at which his performance should be compared in detail with established standards and efforts made to correct his weaknesses and increase his successes. Fourth, management should be constantly studying how jobs can be better done and pass on to the worker the results of such studies. Fifth, management should make up its mind how to tell the worker the things he should know, and sixth, when to tell him.

As far as pay is concerned, management should not be content to accept standards which are so low that the worker can be induced to take a job with another employer. It is an absurd but increasingly disturbing result of governmental wage and salary controls that while it is extremely difficult for an employer to recognize improved efficiency by higher pay to his own staff, it is relatively easy for a new employer to do exactly that for the same individual.

Mr. Appley urged that management should not accept too readily adverse decisions by governmental agencies on proposed promotions, but should continue to fight for them when they are justified, going back again and again with new facts and arguments. Very often, he said, a re-statement of the case with a little change in emphasis or a further bit of evidence will succeed after two or three failures.

Panel Discussion

The afternoon session took the form of a general discussion led by a panel consisting of:

H. H. Scaff, Ebasco Services Inc.

O. H. Ritenour, Washington Gas Light Co.

R. B. Tulpin, Central Illinois Public Service Co.

E. F. Embree, New Haven Gas Light Co.

D. H. Mitchell, Northern Indiana Public Service Co.

A. G. Mitchell, Philadelphia Electric Co. (for H. L. Gruehn, Consolidated Gas, Electric Light and Power Co. of Baltimore).

B. S. Rodey, Jr., Associate Controller of Consolidated Edison Co. of New York, Inc., a former chairman of the Institute's Accounting Committee, who was present as a guest, was also invited to sit as a member of the panel.

Four topics were announced for discussion, each introduced by a member of the panel who then answered questions from the floor. L. E. Reynolds, The Connecticut Light & Power Co., coordinator of the General Accounting activities of AGA presided at the session, introduced the discussion leaders and presented questions prepared in advance by various members of the accounting groups represented at the meeting.

The first topic was "The Organiza-

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tion of White Collar Workers." The discussion emphasized the responsibility of management toward these employees and general agreement was expressed with the views of Mr. Appley as presented at his luncheon talk. Some questions were raised, however, about the desirability of fixing and making public the maximum and minimum pay for each job classification, and there was both assent to and dissent from the view that a completely detailed job classification with pay rates should be adopted and made known to the office force.

Several speakers expressed the opinion that management sometimes is inclined to rely too much as a motive for efficiency on the opportunity that office workers have to rise to higher executive positions, and to ignore dissatisfaction with pay, working conditions, and treatment believed to be arbitrary and unfair. However, all agreed that rate of pay is not generally the major element in such unrest among the "white collar" workers as may exist.

The next topic was "Postwar Extension of Wartime Accounting Techniques." The most controversial question seems to be that of bi-monthly billing and meter reading. Most agreed that there are definite advantages to a utility in the lengthening of the period between meter readings and billings, but questioned whether such advantages are worth the effort to obtain customer acceptance after war restrictions are removed. However, Mr. Tulpin stated that he was convinced from his experience in a territory where service was rendered chiefly in about 500 relatively small cities and villages not highly industrialized that the customers of his company liked bi-monthly billings and would resist a return to the prewar methods.

A point was made that postwar collection policies might have to be liberalized at least in areas where artificial prosperity rising from war industry comes to an end. In times when customers' income is generally good, more rather than less effort should be made to obtain prompt payment of bills for service.

On the subject of "Rate and Cost Yardsticks" lengthy quotations from publications and releases of the Federal Power Commission and from speeches by members of the Commission or its staff were read to show that it is the policy of the Commission to emphasize every comparison which appears to indicate lower rates or lower costs for utility operation by governmental agencies than for privately-owned and operated utilities. It is abundantly clear to those in the industry who know the facts that many of these comparisons are unfair, even eliminating the big issue of tax costs, because the situations compared are not in fact truly comparable; and that if adequate recognition were given to all the factors involved the picture would be very different. It was urged that the privately-owned utilities greatly increase their efforts to get complete analyses of these rate and cost yardsticks before the public and before local regulatory agencies, pointing out the false conclusions that can easily be drawn from a mere comparison without any statement of the circumstances and conditions.

The view was expressed that volume of consumption per customer is a very important factor in comparing rates for service which, however, is too often ignored or unduly minimized. There was general agreement that the industry had not done as good a job as it could and should do in meeting the publicity given to unjust "yardsticks."

On the subject "Depreciated Original Cost as a Basis for Rates," a main point made was that utilities ought not to accept as settled doctrine the use of the "original cost" of their plant less computed straight line depreciation as the sole measure of investment on which their security holders are entitled to a return. It was brought out that in many jurisdictions state laws and state decisions still require revenue to be measured in relation to the value of the plant used and useful for service and that original cost less depreciation does not measure value. As to the straight line depreciation reserve requirement the group was reminded that even with the reservations and qualifications added in the 1944 report of the NARUC Depreciation Committee, last year's annual convention of the NARUC by a close margin had refused to adopt the recommendation of that report for the use of straight line computed depreciation reserve requirement as the standard which rate-making bodies should try to adopt wherever applicable. A speaker urged that where original cost had been determined to the satisfaction of a regulatory authority and entered on the books of account, every effort should be made to secure adequate recognition of the acquisition adjustment accounts either as an element in the rate base or through the acceptance of their amortization charges as legitimate items in operating costs.

One speaker said that if the permitted revenues of privately-owned utilities are to be measured solely by the original cost of the plant stated in the number of dollars shown to have been expended at the time of initial construction, without allowance for changes in the purchasing power of the dollar, such a basis for rate-making could bring about ultimately the end of private ownership through the removal of any inducement to investors to back their judgment of the trend of prices.

The afternoon session adjourned after a vote of thanks to the chairman and panel leaders for a lively and enlightening discussion.

Brief business meetings of the electric and gas committee members were held separately following the close of the panel session.

Altogether the meeting was very successful, considering travel restrictions. Attendance from distant points was well within the ODT limit of fifty, but local committee members and guests brought the registration close to sixty.

Pope Heads P.U.A.A.

E. N. POPE of the Carolina Power & Light Company, Raleigh, N. C., was elected president of the Public Utilities Advertising association at a two-day business session of the organization held in the Edgewater Beach Hotel, Chicago, June 5-6. He succeeds Russell I. Seymour of the Kansas City Power & Light Company.

Other P.U.A.A. officers for the coming year are James V. MacDonald, Boston Edison Company, first vice-president; Charles J. Allen, Connecticut Light & Power Company, Waterbury, Conn., second vice-president; Robert Plowe, Commonwealth Edison Company, Chicago, third vice-president; Waldo M. Wright, Amarillo Gas Company, Amarillo, Tex., secretary, and Dale Remington, Wisconsin Public Service Corporation, Green Bay, Wis., treasurer.

New members of the board of directors are Mr. Seymour, Kenneth Haines, Northern Indiana Public Service Company, Hammond, Ind.; Robert Gros, Pacific Gas & Electric Company, San Francisco, Cal., and Henry Grant, Houston Light and Power Company, Houston, Tex.

Accident Prevention Committee Meeting

H. O. Sprinkle, *Chairman*

THE Spring Meeting of the EEI Accident Prevention Committee was held on May 24 and 25, 1945, at the Roosevelt Hotel, Pittsburgh, Pennsylvania. The 33 persons who were able to be present from 11 States and Canada under prevailing war-time conditions, attests to the keen and continuing interest being taken in this work.

A report on the number of Safety Merit Awards conferred by the Institute during the past three years to member Light and Power Companies for outstanding achievement in accident prevention efforts, indicated that 57 certificates have been issued to 16 companies and divisions thereof for a total of 77,425,250 manhours of accident-free time.

Mr. E. J. Kreh, Chairman of the Subcommittee on Accident Statistics, presented the following preliminary figures on the industry's 1944 accident experience:

ELECTRIC OPERATIONS

	Companies	*Employees*	*Fatal Accidents*	*Lost Time Accidents*	*Total Days Lost*	*Freq. Rate*	*Severity Rate*
1944	233	190,025	82	4,671	717,588	11.95	1.76
1943	278	214,435	118	5,310	936,977	11.73	2.07
			COMBINATION COMPANIES (Not Included in Above)				
1944	17	13,074	10	460	68,270	15.76	2.34

The supporting data for these figures and related additional information will be incorporated in an annual report which will be issued and made available to the industry in the near future.

A proposed revision of the ASA Standard Method of Compiling Industrial Injury Rates was discussed and it was recommended that the industry's representative on the Sectional Committee invite reconsideration of certain provisions in behalf of the Light and Power Group.

Mr. T. R. Claffy, President, W. H. Salisbury & Company, reviewed the rubber situation for the committee and told of the restrictions which continue to govern its use in the manufacture of Linemen's Rubber Protective Equipment. He pointed out that the victory in Europe would have very little bearing on the conditions now existing and again urged that stocks on hand be conserved by all possible practical means.

Substitutes for leather in safety belts and straps were reported as having been developed to a point by some manufacturers where it is expected that these will be recommended and urged for standard use.

A Linemen's Safety Manual on "The Care and Application of Rubber Protective Equipment" being prepared by the committee under the sponsorship of Mr. E. C. Rue, Boston Edison Company, is expected to be ready for publication in June. A similar report on "The Use and Care of Pole Climbing Equipment" is also being prepared under Mr. Rue's direction and is scheduled for completion this fall.

The sound slide film "Pole Top Pals" produced under the sponsorship of the Accident Prevention Committee and recently announced as available to the industry, has already resulted in a total of some 90 odd copies having been ordered by Light and Power Companies throughout the industry and other groups interested in this subject. This film features recommended safe practices on line work and is regarded as an outstanding aid for this purpose. Copies may be ordered through Edison Electric Institute, 420 Lexington Avenue, New York 17, New York, at $10.00 each. Several additional sound-slide pictures of this nature have been scheduled for production under the sponsorship of Mr. C. N. Rakestraw, Chairman of the Subcommittee on Visual Education. (Tips on the planning and making of such sound-slide films are contained in a write-up prepared by Mr. E. C. Rue and are available at the Institute's Headquarters Offices for those interested.)

Mr. W. R. Smith, Public Service Electric & Gas Company, reviewed matters of current interest in the field of resuscitation. Mr. Smith is making a study of successful resuscitation cases reported during the past few years and will present a special report on this subject later in the year.

An extensive and comprehensive bibliography on matters relating to Safety and the Returning Service Men was presented by Mr. R. P. Douglas, The Detroit Edison Company, committee sponsor for this activity. This report was prepared in an effort to assist safety men and others concerned with the reinstatement and employment of veterans.

A significant and revealing analysis of detailed reports on 1,063 Lost Time Accidents that occurred in the Light and Power Industry in 1944, was presented by Mr. D. C. Stewart, Niagara Hudson Power Corporation. Mr. Stewart also briefly described a more significant statistical method of dealing with severity rates that aroused considerable interest and will be the subject of a more complete presentation at a later meeting.

Mr. W. R. Smith distributed the fourth in a series of the Accident Prevention Committee's "Information Exchange" Bulletins. These are devoted to unusual occurrences and items of special interest to safety men within the Light and Power Industry.

A feature of the second day's session was a frank off-the-record discussion of various topics of special and mutual interest to safety engineers in the Light and Power field. Mr. George Diehl, Pennsylvania Water & Power Company, presided during this closed session.

The next meeting of the committee was tentatively scheduled to be held in Baltimore during the month of October, 1945. Final plans for this meeting will be announced later.

Infra-Red Applications

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way we plan to keep infra-red before our own men in the Sales Dept. and also before our customer. We will use advertising folders which will feature infra-red applications and which will be mailed at such time as equipment is more readily available.

We expect that in the post-war period more new applications of infra-red will be developed as reconversion takes place. A good start has been made and with the continued effort and combined cooperation of the power engineers and the manufacturers of infra-red equipment there is every reason to believe that load building in this low temperature field will exceed expectations.

Electrical Equipment Committee Meeting

H. S. Fitch, *Chairman*

THE spring meeting of the Electrical Equipment Committee was held on May 17 and 18 at the Netherland-Plaza Hotel in Cincinnati.

The entire morning session of the closed meeting on the first day was devoted to an informal discussion of apparatus troubles. A summary of the Apparatus Trouble Report prepared by F. S. Brown, for the period August, 1944, to February, 1945, showed 158 cases of trouble with an average of 26 per month, compared with the six-year average of 21 cases per month. Lightning, or lightning arresters, accounted for about 12 per cent of the total number of failures reported. Of the troubles classified as major those occurring most frequently were transformers (over 500 kva)—5, circuit breakers—4 (two each for oil and air breakers), bushings—3, exciters—3, motors—3. Of those classified as minor, the more frequent were induction regulators—22, constant current transformers—15, transformers (over 500 kva)—12, motors—11, bushings—9. Experience with regulators was reviewed with particular reference to their short circuit withstand capabilities.

Mr. Wilbraham reported that the ASA C37 Sectional Committee had secured a unanimously favorable vote in reply to the letter ballot on the new American Standard for Alternating Current Power Circuit Breakers. The Standard is now in galley proof which is being reviewed preparatory to final printing.

Mr. Shew, Chairman of the Working Group on Uniform Requirements for Metalclad Switchgear, summarized the results of the work by his group over the last year which indicated that reasonable agreement had been reached on a number of items although on a few items there was still some variation in requirements. Subject to a few modifications made at the meeting pointing toward further agreement, the report of the working group was unanimously accepted for transmission to the Triple Joint Committee on Power Circuit Breakers for appropriate action.

Mr. Dryar reported on the results of a study indicating that at time of emergencies it would be possible to reduce load by lowering system voltage, slightly more than 1 per cent decrease in load being obtained for each per cent drop in voltage.

There was discussion of the probable effect on system load if War Time were to be dropped. Several of those present estimated the effect of such a change would range between 7 and 10 per cent.

Mr. Fields addressed the meeting briefly regarding the work of the General Engineering Committee, of which he is Chairman.

Under the sponsorship of Mr. Woods the entire morning session of the second day was devoted to a symposium on Distribution Substation Design. This comprised a series of papers by Messrs. Henry, Birckhead, Poage, Snyder, Southgate, Shew, F. W. Smith, Hellenthal and J. C. Jones, and covered a review of fundamental principles as well as a discussion of the trend in practice of various companies. Following the presentation of the papers there was a period of informal discussion, during which a lively interest was shown in the various features of design as well as the overall economics of various types of stations.

Mr. Silver presented a progress report on behalf of Mr. Morris, Chairman of the Meter and Service Committee. This committee has not held a meeting during the past year but work has been going forward in the subcommittees. Letter ballots of the Committee are now in process on the report dealing with safety practices for metermen, and on a tentative standard for bar type current transformers. A subcommittee report on the standardization of thermal demand meter ratings and scales is now under review.

Several cases of system disturbances were reviewed for the information of the committee. In one, which involved operation with frequency below normal, a study of load records indicated a reduction in load of about 2 per cent for each per cent drop in frequency, in addition to the load reduction accompanying decreased voltage.

Results of tests on the effect of cyclic voltage variations on fluorescent lamps were described by Mr. Weise. These indicated that certain types of fluorescent lamps are more sensitive to cyclic flicker than 100 watt incandescent lamp.

Highlights in recent progress and future trends from the manufacturers' viewpoint were presented by S. H. Mortensen of the Allis-Chalmers Manufacturing Company and D. M. Jones of the General Electric Company. On behalf of C. F. Wagner of the Westinghouse Electric and Manufacturing Company, who was unable to be present, J. K. Hodnette discussed the impulse testing of transformers.

Electric Water Systems Council

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gation system, Mr. Studebaker says. "Our first irrigated crop showed a yield increase of 100 per cent and much higher quality.

The new booklet is one of a series of promotional booklets issued in recent years by the Electric Water Systems Council. Previous booklets have emphasized repair and maintenance as well as the importance of running water in the nation's food production program.

A large window and store display piece is being offered for sale at $2.00 each. It is expected that later in the year the Council will produce a sound-slide Educational film for use at meetings in rural areas.

The Electric Water Systems Council is a joint cooperative effort sponsored by the Edison Electric Institute and manufacturers of electric water systems and allied products. The Edison Electric Institute and the manufacturers have been cooperating for 12 years to bring the many advantages of running water to the attention of all farmers.

Substation Design

(*Continued from page* 172)

operations outside of the substation. We have found this scheme very satisfactory and are using it in practically all of our urban areas and have even used it in several substations supplied directly from 115 kv lines.

In rural areas there is often only a single transmission circuit available and in many cases a single transformer bank is used. In such substations, if there are two or more outgoing feeders, the main and transfer bus scheme offers a very satisfactory arrangement and we have used it quite generally.

While there is nothing new or startling in these ideas, we have found that very considerable savings can often be made by getting back and taking a fresh look at a situation with these simple, fundamental ideas in mind.

Transmission and Distribution Committee Meeting

Frank Sanford, *Chairman*

THE Underground Section of the EEI Transmission and Distribution Committee met with the AEIC Cable Engineering Section at the Hotel Netherland Plaza, Cincinnati, Ohio, May 14, 1945, and the following day the regular Spring meeting of the Transmission and Distribution Committee was held at the same location.

AEIC topics discussed during the joint session of the Underground Sections included:

1. Operating Experience with Heavy Loading of Cables.
2. Voltage Rating of Cables with Particular Reference to Preferred Voltage Rating Objectives.
3. Experience with Cable, 2 Kv and Less.
4. Experience with Substitutes for Natural Rubber.
5. Operating Experience of 27 Kv Cable with Reduced Insulating Thickness.

EEI subjects taken up at this joint session included a paper by J. H. Nicholas, G. & W. Electric Specialty Company, on "Electrical Stresses in Potheads." Mr. Nicholas discussed the need for the utmost care in the design and manufacture of this type of equipment, since the electrical stresses developed under abnormal operating conditions are not distributed uniformly over the entire insulating media, but are generally confined to a rather small zone.

G. B. McCabe, The Detroit Edison Company, described his company's experience with lead-alloy sheath for power cables. He told of troubles due to inter-crystalline cracking and of tests that indicated encouraging possibilities for calcium-sheathed cables.

Protective measures taken by the Cincinnati Gas & Electric Company to maintain network and cable operation under flood conditions were described by C. C. Thomas. These included the use of completely submersible protector units with lead cable to the overhead system where transformers are mounted on racks. Other measures included the use of nitrogen gas under three pounds pressure in transformers and the moving of equipment to second floor levels where necessary and possible.

E. F. Nuezel, The Cincinnati Gas & Electric Company, presented a Progress Report on 1943 cable operations which summarized data contributed by 17 operating companies and covered some 14,600 miles of high voltage cable representing an equivalent of 14,500 cable mile-years. The total trouble rate of cable, insulated with impregnated paper (duct lay only), in 1943, was reported as 7.1 as compared to a rate of 5.8 in 1942. The removal rate for 1943 was 2.6 as against 1.3 in 1942. The rate of failure remained the same as in 1942 which was 4.5.

At the EEI Transmission and Distribution Committee meeting on May 15, C. D. Brown, Wisconsin Electric Power Company, reported on the results of a survey covering "Lightning Performance of Wood Pole Lines Below 66 Kv." This report was based on replies from 31 operating companies and covered a wide range of experience in 4 principal voltage ranges, namely, 13.2 Kv, class, 22-35 Kv, 38-40 Kv, and 60-66 Kv.

H. N. Ekvall, Philadelphia Electric Company, presented a paper on "Lightning Performance of 13 and 33 Kv Wood Pole Lines" in his company, and J. A. Rawls, Virginia Electric & Power Company, described "Lightning Experience on the 110 Kv Transmission System" of his company.

Various methods used for mounting transformers in Detroit were described by H. P. Seelye of the Detroit Edison Company, and Ned Crider discussed methods used by the Union Electric Company of Missouri for mounting heavy 3 phase transformers.

W. McLean, Consolidated Gas Electric Light & Power Company of Baltimore, told of various typical and special methods used to support large units up to 200 Kva size on joint use poles in territories served by his company.

A summary of a paper on "Cross Arm Loading Studies" by H. F. Ostman, Union Electric Company of Missouri, was presented by Mr. Crider of the same company, who announced that this report is expected to appear in the technical press in the near future.

T. J. Brosnan, Buffalo Niagara & Eastern Power Corporation, Group Sponsor for Standards and Specifications, reviewed the committee's work on this activity. He told of the considerable progress made at the subcommittee meetings held in Cleveland on April 12 and indicated that several additional standards were nearing completion.

Problems associated with "Emergency Restoration of Service" following widespread damage and interruptions such as are caused by hurricanes, sleet storms, flood conditions, etc., were reviewed in a paper by L. R. Gaty of the Philadelphia Electric Company. Mr. Gaty, who is the committee's Group Sponsor for General Engineering Subjects announced that a subcommittee would be appointed to make a special study of this problem.

The "Emergency Operation Guide" for the distribution department of the Duquesne Light Company was described by E. W. Oesterreich, and the organization program used by the Cincinnati Gas & Electric Company to meet flood conditions in that area was outlined by V. E. Cooper of that company.

A paper on "Cyclic Flicker of Fluorescent Lamps" was presented by W. R. Weise, Cincinnati Gas & Electric Company, and J. W. Anderson, Philadelphia Electric Company, told of the results of a study made by a subcommittee of the PEA Transmission & Distribution Committee of such problems associated with service to "Domestic Room Coolers and Home Freeze Units."

In reviewing the work of the committee during the past few years, the Chairman spoke of the advantages of the flexible program policy which permitted emphasis to be placed on subjects of special war-time interest to the industry. Referring to the "Objectives and Scope of the T & D Committee," the Chairman emphasized the increasing importance of economic considerations and recommended an extension of scope to include certain utilization matters. (A copy of the Chairman's complete statement on "The Objectives and Scope of the T & D Committee" appears elsewhere in this edition of the "Bulletin.")

The next meeting of the committee is expected to be held in October, probably in Cleveland. The exact time and place will be announced later.

PERSONALS

ELMER L. LINDSETH has been elected president of The Cleveland Electric Illuminating Company, and DEAN C. OBER executive vice-president of the company.

As president Mr. Lindseth, formerly executive vice-president, succeeds the late EBEN G. CRAWFORD, who died on April 17. Mr. Lindseth was also elected a director and member of the executive committee.

Mr. Ober, formerly vice-president in charge of operations, succeeds Mr. Lindseth as executive vice-president.

Both Mr. Lindseth and Mr. Ober are graduates of Case School of Applied Science. Both began work for the Illuminating Company while students at Case, and each has spent his entire working life with the company.

Mr. Lindseth started with the company in 1924 as a test helper. He subsequently became production engineer, assistant to the executive engineer, assistant to the president and in 1942 vice-president in charge of sales and related matters. He was advanced to the position of executive vice-president early this year.

He is a graduate of Miami University, Case, and the Graduate School of Yale University, where he received a master's degree in mechanical engineering.

For the past two years, Mr. Lindseth has been active in postwar planning, and is Cleveland chairman of the Committee for Economic Development. He was formerly vice-chairman of the Greater Cleveland Postwar Planning Council. He is a past president of the Case Alumni Association, and a former alumni trustee of Case School.

Mr. Ober entered the employment of the company in 1912 while a student of electrical engineering at Case, working for the company during his college vacations.

He was graduated from Case in 1913, and a year later took a full-time position with the company in its electrical engineering department. In 1917, he became assistant in charge of the department. He was promoted to executive engineer in 1933, and later was appointed manager of operations. His promotion to vice-president was made about a year ago.

Culminating 43 years of service as President of the Georgia Company, P. S. ARKWRIGHT was elected chairman of the board at the annual meeting of the board of directors last month. At the same time, W. E. MITCHELL, Vice-President and General Manager, was elected President.

C. B. MCMANUS, assistant operating manager, was elected a member of the board and appointed assistant to the new president.

Mr. Arkwright continues to be the chief executive officer of the Company. Under Mr. Arkwright's leadership, the company gained the position of one of the outstanding electric companies in the nation. From the time of his first association with the company as a young attorney in the 1890's, Mr. Arkwright has been forward-looking in his views and progressive in his policies.

As a former president of the National Electric Light Association and the Association of Edison Illuminating Companies, he has held the highest honors in the gift of the electric industry. At home, he enjoys the affection of the employees and is regarded by the public as one of Georgia's first citizens.

Mr. Mitchell, the new president, also is highly esteemed both at home and abroad. He is president of the Atlanta Chamber of Commerce and is now in France heading a commission appointed by the War Department to study the effects of airplane bombing on electric generating plants and systems. Earlier in the war, he was called into governmental service as vice-president of the Rubber Development Corporation.

That organization had the job of trying to relieve the critical shortage of rubber through the development of new sources of supply on this side of the world, and it wanted the benefit of Mr. Mitchell's organizing ability and his knowledge of South America. As a young man, he had spent several years there in the electric business and the war agency sent him there to increase the production of raw rubber from the native plants.

A distinguished engineer, Mr. Mitchell is known for his ability to get things done. Since he came to the company from the Alabama Power Company in 1927, his abilities have been employed both in the company's behalf and in many civic activities.

Mr. McManus, the new assistant to the president, joined the Georgia Power Company in 1927 as superintendent of district operations. The following year he was made assistant operating manager. He is an electrical engineering graduate of Alabama Polytechnic Institute, having graduated in 1916. He joined the Alabama Power Company in 1917, but left the following year to enter the United States Army. He was commissioned a second lieutenant in the Corps of Engineers.

Returning to the Alabama Power Company after the war, he was appointed assistant operating engineer, superintendent of the Muscle Shoals steam-electric plant, and a division manager.

JOHN S. WISE, JR., has retired as president of the Pennsylvania Power and Light Company, Allentown, Pennsylvania. Mr. Wise has served 47 years in the electric industry and 39 with Pennsylvania Power and predecessor companies.

C. E. OAKES, president of the Birmingham Electric Company was elected to succeed Mr. Wise as president of Pennsylvania Power. Both Birmingham Electric and Pennsylvania Power are units in the Electric Bond and Share Company system. A. D. ROOT was elected a vice-president of the Pennsylvania Company.

The Board of Directors of Buffalo, Niagara and Eastern Power Corporation has elevated DR. NORMAN R. GIBSON, vice-president in charge of engineering for the Operating Companies of the B. N. & E. system, to the post of Senior Vice-President and has promoted EDWIN S. BUNDY, Chief Electrical Engineer for the Western Division Companies, to Chief Engineer and Vice-President.

ALBERT T. O'NEILL, recently named Chief Counsel of the Corporation and Treasurer ARTHUR W. JACKSON, have also been elected vice-presidents.

One of the world's leading engineers, Dr. Gibson has been with the company and its predecessors since 1918 when he became Hydraulic Engineer for the old Hydraulic Power Company of Niagara Falls. In 1926 he was named Chief Engineer for that company's successor, The Niagara Falls Power Company, and in 1929 became Chief Engineer for B. N. & E. A native of Guelph, Ontario, he attended the University of Toronto from which he graduated with honor with a degree of Bachelor of Ap-

plied Science. He received an honorary degree of Doctor of Engineering from that University in 1931.

Dr. Gibson is Chief Engineer of Niagara Hudson System Companies, Vice-President of Niagara Hudson Power Corporation, and President of Canadian Niagara Power Company, Ltd. In 1930 he was awarded the Elliot Cresson gold medal by the Franklin Institute of Pennsylvania for his invention of the Gibson Method and Apparatus for Measuring the Flow of Liquids in Closed Conduits. That method has become generally accepted throughout the world as an accurate, convenient and economical means of measuring water flow in hydroelectric installations and has been widely used to conduct tests on such Federal installations as the Boulder Dam and Grand Coulee Projects as well as in major hydroelectric installations in many parts of the world.

Mr. Bundy, who succeeds Dr. Gibson as Chief Engineer, graduated from Cornell University with the Class of 1911. He started work shortly after that with the Niagara, Lockport and Ontario Power Company and worked in various capacities in the Western and Central Divisions of the company until 1923 when he was named Electrical Engineer for N. L. & O. Power Company. In 1932 he became Assistant Electrical Engineer for B. N. & E. and four years later became Chief Electrical Engineer. He has also been supervising engineering for the Niagara Hudson System since 1941.

Mr. Jackson, who lives at 430 Washington Highway, Snyder, has been with the electric industry since 1923. A native of Lockport, he started work with the Niagara Falls Power Co. as Supervisor of the Tabulating Department. In 1931 he was named Chief Accountant of the Commercial Accounting Department of B. N. & E. A year later he became Assistant Treasurer of the corporation and was named Treasurer in 1941. He has been Assistant Comptroller of Niagara Hudson Power Corporation and a Director of N. L. & O. Power Company since 1942.

Mr. O'Neill, was recently appointed Chief Counsel of the Western Division Companies succeeding the late Warren Tubbs who died April 2. He has been in the electric utility business for the past thirty-six years, fifteen of which have been with B. N. & E. He is a graduate of Phillips Exeter Academy and Colgate University. He originally came to Buffalo, after having been associated with the Syracuse Lighting Company's Claims and Tax Department, as Resident Manager for the Utilities Mutual Insurance Company, of which he is a Vice-President and Director.

PHILIP J. SAVAGE, vice-president of The Detroit Edison Company, has announced that he has asked to be relieved from active duty after completing 35 years of service with the company. For many years he had executive responsibility for the company's lines, transportation, employment, medical and labor relations policies.

Mr. Savage was born in Detroit in 1885 and attended Detroit schools and the University of Michigan. He has been an active member of the Detroit Board of Commerce for many years.

Employment, medical, personnel and safety work of the company will hereafter report to SYLVESTER F. LEAHY, who is appointed director of employee relations, according to an announcement by James W. Parker, president. Mr. Leahy will report to J. Herbert Walker, vice-president.

Directors of the Empire District Electric Co., Joplin, Mo., have elected JAMES E. HARSH as chairman of the board. Mr. Harsh continues as president of the company, a position that he has held for many years.

In accepting his chairmanship duties, Mr. Harsh relinquished his responsibilities as general manager to D. C. McKEE, vice-president and formerly assistant general manager.

These changes were dictated by the fact that responsibility for operation of the company now rests upon the local board of directors, officers and department heads of the company, as a result of the utility's recent severance from the Cities Service Power & Light Co.

In addition to the above organization changes L. BARTLETT, formerly electrical engineer with Electric Advisers, New York City, has recently become general superintendent of the Joplin utility in charge of all system operations.

PHILIP SPORN, formerly vice-president, has been elected executive vice-president of the American Gas & Electric Co. At meetings of the boards of directors of the operating companies of the American Gas & Electric Co. system held on April 26, Mr. Sporn was also elected executive vice-president and chief engineer of all of them.

After completing his engineering education at Columbia University, Mr. Sporn was engaged in electrical manufacturing and then joined the engineering staff of the Consumers Power Co., Jackson, Mich. He joined the American Gas & Electric Co. 25 years ago. Over a period of years he held numerous positions in the engineering department becoming chief electrical engineer in 1927 and chief engineer in 1932. He was elected vice-president of the American Gas & Electric Co. in 1934. With the formation of the American Gas & Electric Service Corp. in 1937 he was elected vice-president and chief engineer of that organization. As chief engineer he has had direct charge of and the responsibility for the planning, designing and construction of all physical facilities of the subsidiaries of the American Gas & Electric Co., and supervision of their technical phases.

In his engineering activities, Mr. Sporn has been particularly noted for his contributions to the advancing of the technology and economics of high voltage transmission, interconnected system operation and high pressure temperature steam electric generation of power. He has contributed numerous papers and monographs on the subject to the Transactions of the American Institute of Electrical Engineers, American Society of Mechanical Engineers and the American Society of Civil Engineers, and has been a member and chairman of many of their technical committees and of the technical committees of the electric power industry organizations. During the war he has served frequently in an advisory capacity, and at present he is consultant to the War Production Board.

The Board of Directors of Public Service Corporation of New Jersey have elected LYLE McDONALD and JACOB T. BARRON directors to fill vacancies occasioned by the death of the Corporation's former president, EDMUND W. WAKELEE, and the resignation of JOHN L. O'TOOLE who is ill.

Mr. McDonald, vice-president and comptroller of Public Service, has been with the Company since 1916. He started as an accountant, was made comptroller in 1937 and vice-president last year. He lives in Long Valley.

Mr. Barron, vice-president in charge of electric operation, Public Service Electric and Gas Company, started with Public Service in 1907 and has been a vice-president since 1935. He lives at 241 Edgar Place, Elizabeth.

Announcement has been made by the Public Service Electric & Gas Co., Newark, N. J., of the promotion of HOLLIS K. SELS to the position of transmission and distribution engineer to succeed the late Rollin N. Conwell and of THEODORE SEELY to be transmission and substation engineer. OSCAR BAUHAN has been named assistant transmission and substation engineer.

Mr. Sels, who was formerly transmission and substation engineer, became identified with the Westinghouse Electric Corp. in 1919, following graduation from Iowa State College. Completing engineering school in 1920, he was assigned to the central station section of the general engineering department of that company where he worked on transmission and station problems and acted as sponsor engineer for many projects on the Pacific Coast. Starting with Public Service in 1923 as engineer in the office of the transmission engineer, he was promoted to assistant transmission and substation engineer in 1928 and became transmission and substation engineer in 1938.

Following graduation from Stevens Institute of Technology in 1923, Mr. Seely entered the company cadet engineers' course. In 1926 he was assigned to the electric distribution department, central division, and subsequent appointments brought him to the Perth Amboy district and the Elizabeth district. In 1930 he entered the office of the distribution engineer general office, as assistant engineer, was advanced to distribution planning engineer in 1937 and to assistant distribution engineer in 1940. In 1943 Mr. Seely was transferred to the transmission and substation engineer's office as assistant transmission and substation engineer.

Mr. Bauhan has been identified with Public Service since 1923. Because of the large increase in industrial power demand following this country's entry into the war, in 1942 he was assigned the job of coordinating the engineering of the company's facilities with the equipment of the various war industries.

Central Arizona Light & Power Co., Phoenix, have announced recent changes in the organization.

The new appointments include LOUIS K. DOUTRICK, vice-president and general manager; A. F. MORAIRTY, vice-president in charge of public relations work, postwar planning and industrial development; GEORGE H. GROH, general superintendent and chief engineer in charge of all operations and MILTON G. SANDERS, general sales manager.

Mr. Doutrick joined Central Arizona Light & Power Co. in 1928 as chief engineer and general superintendent, the position he held until 1939 when he was appointed vice-president and chief engineer. Previously he was in the employ of the Florida Power & Light Co. as division engineer of the eastern division in Florida from 1923 to 1928.

Mr. Morairty became identified with Central Arizona Light in 1925 to organize the sales department. In 1935 he was appointed vice-president in charge of sales, the position he held until his recent promotion. Mr. Morairty was employed by the Colorado Power Co. from 1911 to 1924 as an engineer and by the Public Service Co. of Colorado from 1924 to 1925.

Following graduation from Penn State in 1923, Mr. Groh was employed by West Penn Power Co. as an engineer. Transferring his interests to Arizona in 1929, he joined the Central Arizona Light & Power Co. as an engineer and in 1937 was appointed assistant general superintendent.

A native of New York, Mr. Sanders received his education at the University of Arizona. He became commercial manager of the Arizona Edison Co. in 1927, serving in that capacity until 1929, when he moved to New York as commercial manager of Peoples Light & Power Co. He became residential sales manager of Central Arizona Light in 1935 and in 1941 was made assistant to the president.

R. G. RINCLIFFE has been elected vice-president in charge of electric operations of the Philadelphia Electric Co.

Mr. Rincliffe entered the utility business as an engineering assistant for the Philadelphia utility company at Chester, Pa., in 1923. Following a succession of various assignments, he was named superintendent of gas production in 1927. Four years later he was made superintendent of gas manufacturing for the entire company.

In 1938, he was named purchasing agent, continuing in that capacity until 1941, when he was appointed manager of electric station operations, the position he held at the time of his selection as vice-president.

Mr. Rincliffe received his education at Yale University and at the Massachusetts Institute of Technology.

VINCENT T. MILES has been elected treasurer of the Long Island Lighting Co., Mineola, N. Y., and its affiliates.

M. H. MONTROSS, vice-president of Wisconsin Public Service Corp., Wausau, was recently elected president of the Wisconsin Utilities Association for the coming year. He succeeds S. B. Sherman, vice-president Wisconsin Gas & Electric Co., Racine.

Other officers elected include: Vice-President, B. E. MILLER, manager rate and valuation department, Wisconsin Power & Light Co.; treasurer (re-elected), ALFRED GRUHL, assistant research engineer, Wisconsin Electric Power Co.

B. V. BOSARD, superintendent of distribution of the Southern Indiana Gas & Electric Co., Evansville, Ind., has retired after completing 41 years of service with the Indiana utility. Mr. Bosard began his career in the electrical industry in 1900 with a Chicago contractor and a year later became identified with the Springfield (Mo.) Gas & Light Co. In 1904, he joined what was then the Evansville Gas & Electric Co., predecessor of Southern Indiana Gas & Electric Co.

H. B. PARRIS, secretary and treasurer of the Dallas Power & Light Co. since 1933, has been appointed vice-president and treasurer of the company. The appointment follows a long career in the electric utility industry, which began in 1914 when Mr. Parris joined the Dallas Electric Lighting & Power Co.

LITTLETON C. ENGLISH, supervisor of the meter and installation department of the Virginia Electric & Power Co. in Fredericksburg, Va., for four years, has been transferred to Alexandria where he will take a similar position. H. HOWARD DABNEY succeeds him in Fredericksburg.

F. MILTON LUDLOW, chairman of the welfare committee of Public Service (New Jersey), has been named general campaign chairman of the 1945 drive of the United War and Community Chest of Newark and West Hudson. The campaign goal will be set at more than $2,000,000 to be allocated to 22 National War Fund agencies and 76 local agencies of the Welfare Federation.

Mr. Ludlow has been with Public Service nearly thirty years and has been active also in the Red Cross and American Legion.

EDISON ELECTRIC INSTITUTE OFFICERS AND COMMITTEES

(Continued)

ADVISORY COMMITTEE

P. S. ARKWRIGHT.....Georgia Power Company, Atlanta, Ga.
D. C. BARNES.....Engineers Public Service Company, New York, N. Y.
H. J. BAUER.....Southern California Edison Co., Ltd., Los Angeles, Calif.
S. R. BERTRON.....Houston Lighting and Power Company, Houston, Tex.
J. B. BLACK.....Pacific Gas and Electric Co., San Francisco, Calif.
JOHN W. CARPENTER.....Texas Power & Light Company, Dallas, Tex.
C. M. COHN.....Consolidated Gas Electric Light & Power Co., Baltimore, Md.
T. D. CROCKER.....Northern States Power Co., Minneapolis, Minn.
J. E. DAVIDSON.....Nebraska Power Company, Omaha, Neb.
SAMUEL FERGUSON .....The Hartford Electric Light Company, Hartford, Conn.
J. F. FOGARTY.....The North American Company, New York, N. Y.
C. E. GROESBECK.....Electric Bond and Share Company, New York, N. Y.
H. P. LIVERSIDGE.....Philadelphia Electric Company, Philadelphia, Pa.
B. W. LYNCH.....San Diego Gas and Electric Company, San Diego, Calif.
P. H. McCANCE.....Duquesne Light Company, Pittsburgh, Pa.
WILLIAM McCLELLAN .....Union Electric Company of Missouri, St. Louis, Mo.
IRWIN L. MOORE.....New England Power Association, Boston, Mass.
A. B. PATERSON.....New Orleans Public Service Inc., New Orleans, La.
H. HOBART PORTER.....American Water Works and Electric Co., Inc., New York N. Y.
PAUL A. SCHOELLKOPF.....Buffalo Niagara and Eastern Power Corp., Buffalo, N. Y.
P. L. SMITH.....The Middle West Corp., Chicago, Ill.
GEORGE N. TIDD.....American Gas and Electric Company, New York, N. Y.
S. B. WAY.....Wisconsin Electric Power Company, Milwaukee, Wis.
J. R. WHITING.....The Commonwealth & Southern Corp., New York, N. Y.
E. A. YATES.....The Commonwealth & Southern Corp., New York, N. Y.

CHAIRMEN OF COMMITTEES (1944-45)

Accident Prevention, H. O. SPRINKLE.....The Monongahela West Penn Public Service Co., Fairmont, W. Va.
Accounting Division General, H. R. FLANEGAN.....Philadelphia Electric Co., Philadelphia, Pa.
Customers Activities, W. A. KELLY.....Consolidated Gas Electric Light & Power Co., Baltimore, Md.
General Accounting, H. P. TAYLOR.....Wisconsin Public Service Corp., Milwaukee, Wis.
Depreciation, F. B. FLAHIVE.....Columbia Gas & Electric Corp., New York, N. Y.
Plant Accounting and Records, A. V. SCHWARTZ.....Columbia Engineering Corp., New York, N. Y.
Purchasing and Stores, T. W. AYTON.....Indianapolis Power & Light Co., Indianapolis, Ind.
Taxation, R. M. DODDS.....Ebasco Services Inc., New York, N. Y.
Commercial Division General, GEORGE M. OUSLER.....Duquesne Light Co., Pittsburgh, Pa.
Engineering Division General, E. S. FIELDS.....The Cincinnati Gas & Electric Co., Cincinnati, Ohio
Electrical Equipment, H. S. FITCH.....West Penn Power Co., Pittsburgh, Pa.
Hydraulic Power, PAUL M. LEFEVER.....Susquehanna Electric Co., Conowingo, Md.
Industrial Relations, H. K. BRECKENRIDGE.....West Penn Power Co., Pittsburgh, Pa.
Insurance, J. H. NICKELL.....Philadelphia Electric Co., Philadelphia, Pa.
Membership, J. F. FOGARTY.....The North American Co., New York, N. Y.
Meter and Service, J. A. MORRIS.....American Gas & Electric Service Co., New York, N. Y.
Prime Movers, E. R. CROFTS.....Rochester Gas & Electric Corp., Rochester, N. Y.
Post War Planning, H. C. THUERK.....New Jersey Power & Light Co., Dover, N. J.
Prize Awards, P. S. YOUNG.....Public Service Electric & Gas Co., Newark, N. J.
Rate Research, F. A. NEWTON.....The Commonwealth & Southern Corp., New York, N. Y.
Statistical, W. N. LEWIS.....Ebasco Services Inc., New York, N. Y.
Transmission and Distribution, FRANK SANFORD.....The Cincinnati Gas & Electric Co., Cincinnati, Ohio
Codes and Standards (a Subcommittee of the Board of Directors), H. B. BRYANS
Philadelphia Electric Co., Philadelphia, Pa.

EDISON ELECTRIC INSTITUTE OFFICERS AND COMMITTEES

OFFICERS

C. W. KELLOGG, *President*.....420 Lexington Avenue, New York 17, N. Y.
J. W. PARKER, *Vice-President*.....The Detroit Edison Company, Detroit, Mich.
H. B. BRYANS, *Vice-President*.....Philadelphia Electric Company, Philadelphia, Pa.
H. S. BENNION, *Vice-President and Managing Director*....420 Lexington Avenue, N. Y. 17, N. Y.
GILBERT W. CHAPMAN, *Treasurer*.....American Water Works and Electric Co. Inc., N. Y.
MAE B. WOODS, *Secretary*.....420 Lexington Avenue, New York 17, N. Y.

BOARD OF DIRECTORS

(Terms Expiring 1945)

H. B. BRYANS.....Philadelphia Electric Company, Philadelphia, Pa.
R. E. DILLON.....Boston Edison Company, Boston, Mass.
J. G. HOLTZCLAW.....Virginia Electric & Power Company, Richmond, Va.
R. H. KNOWLTON.....The Connecticut Light & Power Company, Hartford, Conn.
FRANK MCLAUGHLIN.....Puget Sound Power & Light Co., Seattle, Wash.
W. E. MITCHELL.....Georgia Power Company, Atlanta, Ga.
W. C. MULLENDORE.....Southern California Edison Company, Ltd., Los Angeles, Calif.
W. H. SAMMIS.....Ohio Edison Company, Akron, Ohio
PHILIP SPORN.....American Gas and Electric Service Company, New York, N. Y.
L. V. SUTTON.....Carolina Power & Light Company, Raleigh, N. C.
E. S. THOMPSON.....American Water Works and Electric Company, Inc., New York, N. Y.
G. W. VAN DERZEE.....Wisconsin Electric Power Company, Milwaukee, Wis.
P. S. YOUNG.....Public Service Electric and Gas Company, Newark, N. J.

(Terms Expiring 1946)

H. C. BLACKWELL.....The Cincinnati Gas & Electric Company, Cincinnati, Ohio
W. H. BURKE.....Ebasco Services Incorporated, New York, N. Y.
WILLIAM KELLY.....Buffalo Niagara and Eastern Power Corp., Buffalo, N. Y.
FRANK KRUESI.....Middle West Service Company, Chicago, Ill.
R. E. MOODY.....Union Electric Company of Missouri, St. Louis, Mo.
J. W. PARKER.....The Detroit Edison Company, Detroit, Mich.
H. T. PRITCHARD.....Indianapolis Power and Light Company, Indianapolis, Ind.
K. M. ROBINSON.....The Washington Water Power Company, Spokane, Wash.
E. C. STONE.....Duquesne Light Company, Pittsburgh, Pa.
R. L. THOMAS.....Consolidated Gas Electric Light and Power Co., Baltimore, Md.
WILLIAM WEBSTER.....Massachusetts Utilities Associates, Boston, Mass.
A. EMORY WISHON.....Pacific Gas and Electric Company, San Francisco, Calif.
H. E. YOUNG.....Northern States Power Company, Minneapolis, Minn.

(Terms Expiring 1947)

J. M. BARRY.....Alabama Power Company, Birmingham, Ala.
W. C. BELL.....The United Illuminating Company, New Haven, Conn.
G. A. DAVIS.....Oklahoma Gas and Electric Company, Oklahoma City, Okla.
G. M. GADSBY.....Utah Power & Light Company, Salt Lake City, Utah
R. D. JENNISON.....New York State Electric & Gas Corp., Binghamton, N. Y.
F. C. KELLOGG.....Public Utility Engineering and Service Corp., Chicago, Ill.
G. L. MACGREGOR.....Dallas Power and Light Company, Dallas, Tex.
GROVER C. NEFF.....Wisconsin Power and Light Company, Madison, Wis.
J. H. POLHEMUS.....Portland General Electric Company, Portland, Ore.
P. H. POWERS.....West Penn Power Company, Pittsburgh, Pa.
C. C. SMITH.....Kansas City Power & Light Company, Kansas City, Mo.
FRANK M. WILKES.....Southwestern Gas and Electric Company, Shreveport, La.

(Executive Committee)

The Executive Committee consists of the following members of the Board of Directors: Messrs. W. C. Bell, H. B. Bryans, W. H. Burke, William Kelly, P. H. Powers, W. H. Sammis, E. C. Stone, P. S. Young.